

105 Rec'd PCT/PTO 17 JUL 1998

FORM PTO-1390
REV. 5-93

US DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

ATTORNEYS DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

P-98,1197

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)

09/101846

INTERNATIONAL APPLICATION NO.

INTERNATIONAL FILING DATE

PRIORITY DATE CLAIMED

PCT/DE96/02331

5 December 1996

17 January 1996

TITLE OF INVENTION "CABLE JOINT FOR OPTICAL FIBRES WITH SPLICING CASSETTES AND OVERLENGTH LOOPS"

APPLICANT(S) FOR DO/EO/US Lothar Finzel, Günter Schröder and Heinz Diermeier

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; (PTO 1449, Prior Art, Search Report).
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.
(SEE ATTACHED ENVELOPE)
13. ☒ A FIRST preliminary amendment.
: ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
 - a. ☒ Submission of Drawings - 18 sheets
 - b. ☒ Letter Proposing Drawing Corrections
 - b. ☒ EXPRESS MAIL #EL071032704US dated July 17, 1998

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5)		INTERNATIONAL APPLICATION NO. PCT/DE96/02331		ATTORNEY'S DOCKET NUMBER P-98,1197	
--	--	---	--	---------------------------------------	--

17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO \$930.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) ... \$720.00 No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2)) \$790.00 Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO \$1070.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$ 98.00 <div style="text-align: right;">ENTER APPROPRIATE BASIC FEE AMOUNT =</div>				CALCULATIONS		PTO USE ONLY	

Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).				\$	
--	--	--	--	----	--

Claims	Number Filed	Number Extra	Rate		
Total Claims	68 - 20 =	48	X \$ 22.00	\$1,056.00	
Independent Claims	9 - 3 =	6	X \$ 82.00	\$ 492.00	
Multiple Dependent Claims			\$270.00 +	\$	
TOTAL OF ABOVE CALCULATIONS =				\$2,478.00	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)				\$	
SUBTOTAL =				\$2,478.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				\$2,478.00	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). \$40.00 per property				+	SEE ATTACHED ENVELOPE
TOTAL FEES ENCLOSED =				\$2,478.00	
				Amount to be refunded	\$
				charged	\$

a. ☒ A check in the amount of \$2,478.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 08-2290. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Hill & Simpson
A Professional Corporation
85th Floor Sears Tower
Chicago, Illinois 60606

SIGNATURE

James D. Hobart

NAME

24,149

Registration Number

09/101846

GR 96 P 1041 P
PCT/DE 96/02331
WO 97/26574

- 1 -

1992 Rec'd PCT/PTO 17 JUL 1998

Description

Cable closure for optical waveguides with splice organizers and excess-length depositories

5 The invention relates to an optical-fibre transmission system comprising a cable closure for optical waveguides with splice organizers and excess-length depositories for excess lengths of optical waveguide and comprises at least one optical-fibre cable, cable lead-in units in the form of cable lead-in spigots being arranged
10 into the cable closure perpendicularly with respect to the axis of the closure body of the cable closure, the excess lengths of optical waveguide and the splice organizers being arranged within the closure body removably in the axial direction of the closure body, and at
15 least one end face of the closure body being closed off in a sealing manner by an externally accessible cover.

DE 39 04 232 - A1 discloses cross-connecting and branching accessories for communication cables and distribution networks, comprising a branching junction
20 box and at least one branch cable closure housed therein. Used there is a hood closure with customary cable lead-in seals, the cables led into the branching junction box being laid with excess lengths so that the hood closure can be taken out for service work. The cables are fed to
25 the hood closure via separately laid cable ducts, corresponding excess lengths of the cables being deposited in the cable junction box or manhole before they are led into the hood closures. For service work, the hood closures are lifted or swung out of their manhole position, so that the hood closure is then accessible and can
30 be opened. However, such cable installations are designed for a normal laying method of freely layable cables.

AMENDED SHEET

US Patent Specification 4,709,980 discloses a cable closure in which the cable lead-ins of the optical waveguides are arranged perpendicularly with respect to the axis of the cable closure. Contained therein are splice organizers, which can be removed upwards after opening a cover.

German Patent Specification 41 40 701 C1 discloses a cable closure as an underfloor container in which the cable lead-ins take place perpendicularly with respect to the cable closure axis, the lead-ins being performed via lead-through flanges, so that the cables also have to be provided with corresponding units. Organizers which can be removed upwards are likewise included here.

EP-A-0 532 980 discloses a hood closure with lead-in spigots which, running in obliquely from below, are fitted into a base plate of the hood closure. Such a cable closure is designed for use in cable shafts and, if appropriate, for fastening to masts.

JP-04289451 describes a protective housing for a cable closure arranged in the ground. This protective housing comprises annular components which are arranged on a base. The closure is mounted therein on a frame and surrounded with filling material.

JP-61148782 describes a cable closure in which optical-fibre cables are led in axially. The cable closure comprises a lead housing and is designed such that organizer arrangements for excess lengths of optical waveguide can be arranged lying therein. This cable closure is particularly suitable for use in cases where there are great temperature changes. The seals are established by welding.

5 The object of the invention is, however, to
provide a cable closure for optical waveguides which is
suitable for easy-to-lay minicables or microcables, these
minicables or microcables comprising pipes in which
10 optical waveguides or optical waveguide bundles are
loosely led in. The object set is achieved according to
a first way with a cable closure of the type explained at
the beginning by the cable lead-in units being designed
as lead-in spigots in the form of pipes tightly fitted
15 on, by the optical-fibre cables in the form of optical
waveguide minicables or optical waveguide microcables,
respectively comprising a pipe and optical waveguides,
optical waveguide strips or optical waveguide bundles
loosely introduced therein, being arranged in the cable
20 lead-in units designed in terms of pipe connecting
technology for receiving and sealing off the pipes of the
optical-fibre cables, the sealing connection of the pipe
connecting technology being a welded, soldered or
adhesively bonded connection between the pipe of the
optical-fibre cable and the cable lead-in unit.

The object set is, however, also achieved accord-
ing to a second and third way, corresponding to the
features of Patent Claims 2 and 3.

25 The new type of design of optical-fibre cables as
minicables or microcables allows considerable advantages
to be achieved in terms of laying technology. For
instance, first and foremost there is a drastic reduction
in costs, since the thin pipes of the optical-fibre
cables can be laid in slits which are easy to make in the
30 surface of the ground, so that a distinct reduction in
the overall line costs for a new installation is poss-
ible. In addition, an increase in the operational reli-
ability is possible by redundant routing, which is
particularly suitable if a ring form of network structure
35 is implemented.

For example, by using optical switches to connect up to existing networks, these easy-to-lay microcables allow flexible and intelligent networks to be built up in a simple way. Simple pigtail rings with optical switching
5 can be used in this case, so that optical fibres can be used right up to the final subscriber. The great advantage is also that these simple microcables can be introduced at a later time into roads, pavements, kerb-stones, in the plinth region of walls of houses and
10 special routes. In such cases it is possible to put into practice a technical concept adapted according to the wishes of the operator, allowing account to be taken of existing infrastructure with respect to rights of way, pipes for waste water, gas and district heating. The
15 laying of the microcables is particularly easy to manage in this respect, since the pipe diameter of the micro-cables is only between 3.5 and 5.5 mm, so that

a cutting width of 7 to 10 mm is adequate for the laying channel to be made. Such a laying channel can be accomplished with commercially available cutting machines, a cutting depth of about 70 mm being quite sufficient. The pipe of such a minicable or microcable may consist of plastic, steel, chromium-nickel-molybdenum alloys, copper, copper alloys (brass, bronze, etc.), aluminium or similar materials. The cable closures according to the invention are preferably cylindrically designed and are fitted perpendicularly into a core hole cut out for this purpose and having a diameter corresponding to the cable closure, the core hole preferably being about 10 to 30 mm greater than the diameter of the cable closures. The closure height of the cable closure is about 200 mm, it preferably being designed in a pot shape and pointing with its end-face opening towards the surface, which opening can then be closed off in a pressure-watertight manner with the aid of a cover and a seal. The closure body itself is inserted for example by up to 2/3 of its height into a concrete bed and thereby receives adequate anchorage. The upper part of the core hole is then plugged with lean concrete, hot bitumen, two-component casting compound or expandable plastics materials. The closure cover may also be designed to withstand loading, but a separate covering with an additional manhole cover is also possible. It is consequently a pressure-water-tight cable closure which can be opened and reclosed at any time and has special cable lead-in units for minicables or microcables. The cross-connection excess length of the optical fibres or excess length of optical waveguides for subsequent splicing and all optical-fibre splices are accommodated in the closure body itself, these splices being mounted on a corresponding splice organizer. This splice organizer can be removed upwards in the axial direction of the cable closure, so that the closure itself can remain in its position. The optical waveguides are protected by a flexible tube, so that there is no risk of buckling during service work. For example, up to four tubular microcables may be led into

the cable closure, the cable lead-in units for this purpose preferably being arranged on one side of the closure housing such that a tangential leading in of the optical waveguides along the inner wall of the closure is possible. The radius of the cable closure in this case corresponds at least to the minimum permissible bending radius of the optical waveguides, so that no additional protective devices have to be provided. The cable lead-in units comprise, for example, soft-metal tubes fitted in a sealtight manner into the wall of the closure, the ends of which tubes are plastically deformed by crimping on the led-in microcable ends such that a pressure-watertight seal is produced. In the case of such a pressure-watertight connection, the microcable with its pipe is additionally fixed adequately against tensile, compressive and torsional stresses. To be able to allow for tolerances in the laying of the microcable, the microcable is in each case provided with an elongation loop before it is led into the cable closure, so that as a result length compensation can take place. Such an elongation loop is provided before the cable closures or before bends in the microcable. Such an elongation loop may be additionally provided with a metallic protective tube, which allows only buckle-free bends, so that it is possible to dispense with further bending tools during installation. These length compensation loops for microcables also compensate for possibly occurring elongations or shrinkages of the cable, as well as settling in the road or in the earth. They likewise comprise readily bendable metal tubes, for example of copper, and can be made pliable by prior heat treatment in the bending region. It is also possible to make the tubes used for the length compensation loops flexible by corresponding coiling. Metal tubes also accomplish stability against transverse compressive stress and ensure that minimum bending radii of the optical waveguides are maintained. In addition, the length compensation loops may already be prefabricated at the factory and consequently no longer need to be produced on site. During laying,

the microcables may also be brought up to and fixed to the closure above ground, the length compensation loop then receiving the excess length of cable when the cable closure is lowered. Depending on the configuration and requirements, such an in-line or branch cable closure may be produced on site, T-shaped or else cross-shaped branches being possible.

To realize the invention, slender, elongate closures may be used, in particular if it is a case of lengthening and repairing a microcable. In the case of such in-line cable closures, adaptations of microcables of different diameters can also be performed. For example, such a cable closure may on one lead-in side have a microcable of a first diameter led into it in a sealing manner and on the second side of the cable closure be lengthened by a microcable of a second diameter, different from the first diameter. The adaptation to the different diameters may take place with the aid of lead-in elements of different diameters or with the aid of adapted adapter pieces or adapter pipes.

Particularly advantageous are, however, in this case, round, cylindrical closure bodies, the axis of which however runs perpendicularly with respect to the axis of the laying direction. In this way, the microcables may be led into the closure through tangentially arranged cable lead-in units. As a result, it is also possible to bring together in a single closure microcables from different laying depths. Within the closure, it is also possible for example to realize the splicing technique for uncut microcables, the excess lengths of fibre then expediently being deposited in a clearly arranged way in a plurality of loops one above the other within the closure.

In the case of such cable closures according to the invention, it is also of advantage that the cable lead-in units, and consequently the seals of the cables to be led in, are independent of the end-face

5 cylinder seal of the cable closure. In addition, each
tubular microcable is individually sealed off and the
cable lead-in units are preferably arranged in the middle
or lower part of the cable closure, in order that no
10 crossings of excess lengths of fibre or fibre run-ins
occur. The storage space for the excess lengths of
optical waveguide is preferably arranged directly under-
neath the cover, it being possible additionally to use
separating plates, to be able, for example, to separate
15 incoming optical waveguides from outgoing optical wave-
guides. In this way, the splicing space can also be
divided off. When taking out the splices for service
work, in each case the excess lengths of optical
waveguide must always be taken out first, to allow
20 splicing work to be performed. The splices may
subsequently be accommodated vertically or horizontally
in a splicing space, expediently being arranged on a
splice organizer, on which excess lengths of optical
waveguide may also be arranged in a clear manner.

20 The cable closure according to the invention may
also comprise a plurality of rings, which may be placed
one above the other, depending on size requirements one
against the other. The individual rings are then sealed
off with respect to one another, for example by sealing
25 measures which are normal and known per se. In the case
of such a dividable cable closure, uncut cables may also
be inserted if leading in takes place in this plane of
intersection. This provides the possibility for appli-
cation of the splicing technique.

30 This new technique thus gives rise to various
special features. For instance, the cable closures
according to the invention can be introduced into the
road surfacing in a simple way in standard core holes,
the composite structure of the carriageway surfacing not
35 being destroyed by this core-hole drilling. The laying of
the minicables or microcables and the associated closures
may be performed in a simple way in any areas of the
earth or of the road, preferably along a joint between

the carriageways, introduced in channels or core holes. In the case of such a laying technique, the basic structure of the carriageway surfacing is not disturbed. Earth is not removed. Compaction of the earth is not required.

5 Sinking of the repair site due to settlement is not to be expected. Cracking up or crack propagation is not to be expected. Laying in a laying channel made with customary cutting machines is a simple operation and closing is performed, for example, by pouring in hot bitumen or

10 other fillers. The compact structural design and the relatively small diameter of the cable closure provide adequate load-bearing strength, the sealing of the round closure fastening not presenting any difficulties, since the cover seal is separate from the cable seals. So-

15 called fibre handling and the fibre run-in may take place on a plurality of mutually separate levels, so that better utilization of the volume of the closure can be achieved. The radius of the inner wall of the closure is designed such that it supports the incoming optical

20 waveguides, buckling not being possible.

Elongate cable closures for the connection technique with the microcables used are suitable in particular for through-connections or when lengthening microcables with different materials or different pipe

25 diameters. It is possible, for example, even in domestic cable laying to connect to elongate closures so-called "blown fibre conductors".

Round, cylindrical closures are suitable in particular for changes in direction in the running of the

30 cables, for cross-connecting, splicing, measuring, branching, dividing, overcoming differences in height in the case of laid microcables and for receiving optical switches and the electronics for the transmission technology.

Other developments of the invention are reproduced in subclaims.

The invention is now explained in more detail with reference to 32 figures.

- 5 Figure 1 shows the longitudinal section through an elongate closure for microcables of the same diameters,
- Figure 2 shows an elongate closure for microcables of different diameters,
- 10 Figure 3 shows a longitudinal section through an elongate closure with a microcable fitted on one side,
- Figure 4 shows a cylindrical closure,
- Figure 5 shows a cylindrical closure with a storage space for excess lengths of optical waveguide and depositing and fastening of the splices,
- 15 Figure 6 shows a cylindrical closure in longitudinal section,
- Figure 7 shows a cylindrical closure with pulled-out excess lengths of optical waveguide,
- 20 Figure 8 shows a round closure with cable lead-in units at different levels,
- Figure 9 shows a round closure, which is cut in the leading-in direction and is suitable for the splicing technique,
- 25 Figure 10 shows an extendable round closure,
- Figure 11 shows a cylindrical closure with compensation loops and tangential cable lead-in units,
- Figure 12 shows a round cable closure with protective tubes for the optical waveguides in a view from above,
- 30 Figure 13 shows a round closure with microcables pushed into the interior of the closure, in a view from above,
- Figure 14 shows a cylindrical cable closure which has been fitted into the road surface,
- 35 Figure 15 shows a cylindrical cable closure, with a concrete protective housing,
- Figure 16 shows a cable closure in a simple configuration,

- Figure 17 shows an in-line closure which has been built into the road surface and the cover of which has a peripheral collar,
- 5 Figure 18 shows in a diagram the arrangement of a closure in the case of a through-connection,
- Figure 19 diagrammatically shows an arrangement of the cable closure in the case of a T-branch,
- Figure 20 shows in a diagram the arrangement in the case of a cross-shaped branch,
- 10 Figure 21 shows an elongate cable closure with diameter adaptations in the form of tubular adapter pieces or adaptation sleeves,
- Figure 22 shows the cable closure according to the invention in a longitudinal section,
- 15 Figure 23 shows a sealing head in cross-section,
- Figure 24 shows a splice arrangement in series,
- Figure 25 shows an arrangement of optical-fibre splices next to one another,
- Figure 26 shows a distribution or branch cable closure,
- 20 Figure 27 shows an assembly device for the installation of the cable closure,
- Figure 28 shows the bringing together of the different optical waveguide transmission systems,
- Figure 29 shows how they are brought together if the manhole is in the free earth,
- 25 Figure 30 shows an open core hole with a laid-in elongation loop of a microcable,

Figure 31 shows the inserted protective device,
Figure 32 shows a cable closure which is accessible from
above.

Represented in Figure 1 is a slender, elongate
5 cable closure according to the invention, by which a
connection of tubular minicables or microcables is made
possible. The minicables or microcables comprise in each
case a pipe 8 or 10 - here of the same diameter - in
10 which the optical waveguides 11 are drawn in, blown in or
laid in before the pipe joining process. Within the cable
closure 1, the optical waveguides 11 are connected to one
another by means of splices 26. The in-line cable closure
1 comprises a tubular middle part 19 with end-face ends
16, on which external threads are arranged. The lead-in
15 pipes 8 or 10 of the minicables or microcables are led in
in a sealing manner with the aid of sealing inserts 14
and/or cutting rings, the necessary sealing pressure in
the cable lead-in units 17-18 being produced with the aid
of over-engaging union nuts 17, which have an internal
20 thread 18 in each case at their free ends. The complete
cable closure 1 is sunk below the road surface 6 into the
earth 7 or into cut-in laying channels. Since it consti-
tutes high mechanical protection for splices 26, it may
also be used above ground, for example on masonry plas-
25 ter.

Represented in Figure 2 is an elongate in-line
cable closure 2, in which microcables 9 and 15 of differ-
ent diameters are connected to each other. In this case,
the same connecting and sealing technique as in the case
30 of the cable closure 1 according to Figure 1 is used, the
only difference being that the lead-in diameters at the
end faces of the cable closure are different and are
adapted to the respectively led-in microcable 9 and 15,
respectively.

Shown in Figure 3 is an in-line cable closure 1a,
the left-hand lead-in side of which corresponds to the
exemplary embodiment according to Figure 1, while the
right-hand lead-in side has a profiled

inlet spigot 4, onto which the continuing microcable 3 is fitted and is correspondingly sealed off. The sealing may take place by adhesive bonding or crimping on of the microcable pipe on the lead-in spigot. This exemplary embodiment may be used in particular in the case of the "blown fibre" technique, in which optical waveguides are blown in at a later time in a laid hollow pipe. The hollow pipe 3 concerned, for example of plastic, can be readily fitted onto the lead-in spigot 4 of the cable closure 1a.

The exemplary embodiments shown in Figures 1 to 3 and 21 are suitable as straightforward in-line cable closures, in which there are no excess lengths of optical waveguides, so that they are used as straightforward repair and connection links between the minicables or microcables.

Represented in Figure 4 is a round, cylindrical cable closure 5, which can, for example, be sunk vertically into a core hole in the earth or in the road structure. The cable lead-in units 37 are arranged tangentially at the wall of the closure so that the optical waveguides 24 of the fitted-on microcables 10 can be taken further along the inner wall 22 of the closure. In this way it is possible, for example, for the excess lengths of the optical waveguides to be deposited in an ordered way. For required splices 26, the optical waveguides 24 are taken out from the excess-length assembly and spliced. In doing so, it must be ensured that bending in the splice depository does not go below the permissible minimum bending radius 39 of the optical waveguides. The cylindrical interior space 23 of the cable closure 5 may be separated into appropriate compartments in a corresponding way for the individual functions, the splices 26 being deposited in a horizontal plane in the case of this exemplary embodiment.

Figure 5 shows an exemplary embodiment for a cylindrical closure 5, in which the optical waveguide splices 26 are arranged vertically in the cylindrical closure space. Used for this purpose in this case are,

for example, sickle-shaped splice organizers 32, which can be taken out vertically upwards for service work. The led-in optical waveguides 24 are deflected by means of indicated guides 25 such that it is not possible for bending to go below the minimum permissible bending radii.

Represented in Figure 6 is a cylindrical cable closure 5 for microcables, which is closed off towards the earth side in a hood shape and is accessible from the surface 6 via a cover 20. The cover 20 can withstand high loading and closes off the cable closure 5 pressure-watertightly by means of a sealing system 21. In the case of this embodiment shown, the cable lead-in unit 13 is housed in the upper part of the closure, to which the pipe of the microcable is connected in a pressure-tight manner, with the aid of an adaptation sleeve 87. The optical waveguides 11 are led in through this cable lead-in unit 13 and deposited in excess lengths on a plurality of levels within the closure space. Here, the excess lengths 30 of the led-in optical waveguides are stored in the upper deck 28 and the excess lengths 38 of the outgoing optical waveguides are stored in the lower deck 28a. The lead-throughs 41 in the respective separating plates 29 make it possible for the optical waveguides to be led through from one level to the other. The lower region of the cable closure serves as splicing space 23, in which the splices 26 are fastened on removable splice organizers 32. If service or splicing work is necessary, after removal of the cover 20 the excess-length assemblies 30 and 38 are taken out, so that finally the splice organizers can be removed. The hood-shaped termination of the inner wall 22 of the cable closure 5 is curved such that it can serve as a guide for the optical waveguides 31 leading to the splices. The marking 25 is intended to indicate that corresponding guides for optical waveguides or optical waveguide groups can also be used in the splicing space, allowing the clarity of the arrangement to be improved. The leading away of the optical waveguides into the connected

pipe of the outgoing microcable takes place in turn via a cable lead-in unit 13, which is arranged here on the level of the storage space 28a for the outgoing optical waveguides 38. The sleeve-shaped cable lead-in units 13 are drawn here diagrammatically as crimpable lead-throughs, but according to the special configuration provided by the invention they may also be fitted on tangentially, so that here too the advantages described above come to bear.

In Figure 7 it is shown how the removal of the individual units from the cable closure 5 according to Figure 6 proceeds for service work. Thus, first of all the excess lengths 30 of the incoming optical waveguides and then the excess lengths 38 of the outgoing optical waveguides are removed upwards, so that access to the splicing space, and consequently to the splice organizers 32 located there, is then free. As the arrow 42 indicates, the splice organizers 32 can then be taken out upwards and be deposited in corresponding splicers.

Figures 8 to 10 show basic units from which the cable closures according to the invention can be assembled. These basic units are let into corresponding core holes in the earth or road surface 6.

Advantageous in this case is the cylindrical shape of the closure, which is closed off at one end by a flat base. As a result, under static loading from above, the forces are distributed evenly over a large surface area. Sinking into the road soil is not to be expected even when there is a high volume of traffic.

Figure 8 shows a simple form of the cable closure 5, the cable lead-in units 13 being arranged at different levels. As a result, differences in height between the cable routes, as occur between road laying (about 7 - 15 cm) and earth laying (about 70 cm), can be overcome. This embodiment comprises a single housing

of the interior space 23, which can be provided with the details described above. The cable lead-in units 13 may be sealed off, for example, by sealing nipples, which are inserted at the point 37.

5 Presented in Figure 9 is an exemplary embodiment which comprises a plurality of sections 33 and 35, which are arranged one above the other. Here, the cable lead-in units 13 and 36 are arranged in the separating plane between the two sections 33 and 35, so that it is possible also to lead in uncut microcables or uncut optical waveguide conductors. This makes it possible to apply the splicing technique here. In the case of a cable closure of cylindrical configuration, the sections 33 and 35 are individual rings which contain suitable sealing systems in the separating plane. A flat base 40 was chosen here as the termination.

10 Figure 10 shows that a cylindrical cable closure can also be assembled, for example, from three individual sections, if appropriate rings, it being possible by turning the individual sections to alter the direction of the cable lead-in units 13. Thus, for example, with such a cable closure a right-angled branch can also be realized. Here too, corresponding sealing systems are used in the separating planes 34 between the individual sections.

15 Shown in Figure 11, likewise in a diagrammatic way, is the structural design of a cylindrical cable closure 44, in which the cable lead-in units 45 are led into the closure body tangentially in the form of tubular attachments. In this way, the optical waveguides can be continued in the interior of the cable closure along the inner wall of the closure without the risk of buckling. Furthermore, it is shown that the cable lead-in units 46, which in the case of this example are likewise led in tangentially, are provided with so-called compensation loops 47. These compensation loops 47 serve to

compensate for tolerances during laying of the micro-
cables and installation of the closures or else to
compensate for longitudinal movements in the case of
different coefficients of thermal expansion. The diameter
5 of these compensation loops is dimensioned such that in
any event bending does not go below the minimum permis-
sible bending radius of the optical waveguides, it having
to be ensured that the compensation takes place without
buckling under normal loading. It is also indicated in
10 this diagram that, because of the excess lengths of
optical waveguide 49, the splice organizer 48 with
corresponding splice reserve 50 can be taken out from the
closure in the service position in direction 51. In
protective tubes 54, the optical waveguides are protected
15 against mechanical loading inside and outside the closure
and ensure buckle-free handling, without bending going
below the minimum bending radius. The protective tubes 54
lead the optical waveguides from the cable lead-in unit
45, 46 up to the splice organizer 48. The depositing of
20 the cross-connection excess length 49 in the interior
space of the closure in the closed state is indicated by
dashed lines. The connection to the microcables at the
cable lead-in units 45 and 46 is explained in more detail
below. At the top right, an unused cable lead-in 45 is
25 sealed off by a dummy plug 90. At the bottom right of the
figure, a crimped connection 89 with respect to the
microcable 10 has been shown in principle.

In Figure 12, a cylindrical cable closure 44 is
sketched in a view from above, in which the cable lead-in
30 units comprise microcable lead-throughs 56, through which
the optical waveguides are led into the interior of the
cable closure. The lead-ins are in this case arranged
virtually tangentially with respect to the inner wall of
the housing, the free, outwardly pointing end being
35 expanded in the shape of a nozzle in this representation,
in order to be able to thread the optical waveguides into

GR 96 P 1041 P
PCT/DE 96/02331
WO 97/26574

- 15a -

the flexible protective tube 54. These protective tubes
54 are fitted 55 onto the inner side of the cable lead-in
units 56. For connection of the pipes 9 of the micro-
cables, usually a crimp sleeve is used. Likewise, how-
5 ever, as shown here,

AMENDED SHEET

a shrink tube piece 57 may also be used. The optical waveguides of the microcables are fed to the individual regions, for example the splice organizers 48, through the cable lead-in units and through the flexible protective tubes 54 via compensation loops 53. The transition may take place with the so-called maxibundle adapter. Consequently, if required, optical waveguides may be divided between a plurality of protective pipes. There is also the possibility of dividing the optical waveguides within the splice organizers 52 between a plurality of organizers 48. For this purpose, the optical waveguides are led through the bottom of the organizers 48.

Figure 13 shows in a diagram an in-line cable closure built into the road surface, in a view from above. In this way, the individual microcables 9 can also be pushed into the interior of the closure. The tension relief and the sealing likewise take place by crimping at the points 58. It is also possible to use, however, as shown here in the left-hand half of the figure, an additional shrink tube 59 or a permanently elastic annular seal, with the aid of which the sealing with respect to the cable lead-in unit 56 takes place. Furthermore, sealing could also take place in the interior of the cable closure 44, at the end of the lead-through, with corresponding sealing means 60. Suitable for this purpose is, for example, an annular lip seal 60, which is shown in principle as a shaft-sealing ring in the right-hand half of the figure.

Shown in Figure 14 is an in-line cable closure 61 which is built into the road surface 6 and is fitted in a metallic protective housing 64 such that it is protected against mechanical loads. A cast iron cover 68 is captively fastened by a pivot bolt 67 to the protective housing 64. The protective housing 64 has an opening 63 in the wall for leading in the microcables 62. The protective housing 64 is concreted into the core hole in the road surface 6 in the lower region, as item 65 shows, in order to prevent sinking. The remaining annular gap is closed with hot bitumen or 2-component

casting compound 65a. The cover 68 is slightly counter-sunk with respect to the carriageway surfacing and is accessible at any time for service work. The sealing cover 73 is described further below. The protective housing 64 and the cable closure 61 are arranged concentrically with respect to each other, it being possible for the intermediate space to be provided with a flexible foam filling 66.

Figure 15 illustrates a sketch of an in-line cable closure built into the road surface 6 and having a concrete protective housing 71, which protects the in-line cable closure against mechanical loads. Such a protective housing of precast concrete is suitable in particular for sinking into a paved road surface. Here too, a cover 74 which can withstand high loads is provided, which cover is let into a ring 75. Here too, a pivot bolt 67 is provided. The cable lead-in units 70 are not flexible here and, because of the microcables 62, have to be led into the cable closure 72 rectilinearly. The cable sealing takes place outside the concrete protective housing 71 by crimping 58 (left-hand side) or with the aid of a shrink tube piece 69 (right-hand side). Any compensation loops must be situated outside the concrete protective housing 71 and are not shown here. The cable closure 72 is closed upwardly, underneath the load-withstanding cover 74, by a sealing cover 73. The latter seals off the closure space downwardly by an O-ring 91. In this diagram, the sealing cover 73 is secured and fixed, for example, by an annular screw.

Figure 16 illustrates in a diagram an in-line cable closure 72 built into the road surface 6, and this being a simple mechanical cable closure for microcables. For reasons of overall clarity, the cable lead-in units already explained above have not been shown. The cast cover 76 absorbs the mechanical loads and leads them directly into the closure housing 72. The cast cover 76 is provided with a centring groove 77, which ensures non-slip support. For the guidance

of the cast cover 76, hinged devices 67 and 78 are provided at the sides, by which devices adequate positioning is ensured. The cable closure 72 is in turn separately sealed off upwards, underneath the cast cover 5 76, by a sealtight cover 73. The sealing takes place, for example, by an O-ring 91. The cover 73 is fixed in this diagram by securing wedges or securing pins 92, which provide adequate cover-pressing onto the O-ring.

Shown in Figure 17 is a cable closure 72, which 10 corresponds to that from Figure 16, the load-bearing cover 80 here having a peripheral collar 81. By this peripheral collar 81, the cast cover 80 is fixed adequately against shifting on the peripheral wall 79 of the cable closure 72. The cover 73 is in this case fixed by 15 a snap ring (Seeger circlip), which locks into an annular groove. Opening takes place by means of special pliers. The closure is secured against unauthorized access.

Figure 18 illustrates in a diagram the conditions in the case of a through-connection of microcables 84, 20 which are connected via connection units 82 and compensation loops 47 to the cable lead-in units of the cable closures 44. To reduce the variety of types, the closures are provided, as standard as far as possible, with 4 cable lead-in units. If not all the cable lead-ins are 25 required, unoccupied cable lead-ins can be closed off pressure-watertightly by dummy plugs.

Figure 19, on the other hand, illustrates the principle in the case of a T-branch of microcables 84. Here, likewise two of the microcables 84 are led into the 30 cable closure 44 in the way described above, a further microcable 84 being led out, perpendicularly with respect to this first routing, tangentially from the cable closure 44. In this case, the branched-off microcable 84 is led in via a cable lead-in unit 83 directly without a 35 compensation loop. The compensation loop 47 has

in this case been provided on the cable end of the microcable 84. Unused cable lead-ins are closed pressure-water tightly by a dummy plug.

5 Sketched in Figure 20 is a cross-shaped branch, in which the basic principles shown in Figures 18 and 19 are applied. In this case, it may be expedient for the compensation loops for the branching-off microcables 84 to be pulled up in a bow shape, as is indicated at the point 85. Compensation loops 47 are provided directly at
10 the microcable ends.

 It can be seen from the diagrammatically illustrated basic principles in Figures 18, 19 and 20 that a cylindrical cable closure according to the invention is particularly advantageous for the laying of minicables or
15 microcables. On account of the possibility of tangentially leading in the relatively rigid pipes of the microcables, changes in direction in the routing can be arranged without any problems.

 Depicted in Figure 21 is a variant of the slender
20 in-line cable closure 1b. In the case of this closure, the led-in pipes 8 and 10 are permanently fixed by plastic crimping of a softer metal. For this purpose, adapter pieces 87 of soft metal are crimped onto the pipe ends pressure-watertightly and permanently. An outer pipe
25 88, which is crimped onto the adapter pieces 87 at both ends, protects the splices 26. The inner bore of the adapter pieces 87 can be matched to the external diameter of the respective microcable 8 or 10.

 The compensation loops 47 may be provided both at
30 the cable lead-ins or cable lead-in units and directly at the ends of the microcables.

 The cable lead-in units of the cable closure may also be designed as flange units, plug units inserted in a sealtight manner

being provided for the connections of the optical waveguides. The optical waveguides are likewise provided with plug units, so that connection without any problems can take place, the ends of the minicables or microcables
5 being provided with adapted flange units for sealtight coupling.

Furthermore, the complete cable closure, comprising closure body, cover, splice organizer, protective tube for excess lengths of optical waveguides, cable
10 lead-in units, sealing systems, crimp connections and compensation loops, may be prefabricated in the factory.

A development of the invention is based on the object of providing slender in-line or vault cable closures for microcables, the diameter of which closures
15 is only slightly greater than the diameter of the microcable and in which closure the microcable inlets can be sealed off by simple sealing methods. The object set is achieved with a cable closure of the type explained at the beginning by sealing heads of deformable material,
20 preferably of a metal, being crimped onto the pipes of the optical-fibre cables in a sealing manner at peripheral crimping points, by the closure pipe likewise consisting of deformable material, preferably of a metal, and being crimped on at its end faces onto the sealing
25 heads at peripheral crimping points and by the closure pipe being dimensioned in length such that adequate excess lengths of optical waveguide can be arranged in waveform extent and optical-fibre splices can be arranged.

It is furthermore the object of a development of the invention that, with such an in-line or vault cable closure, a sealtight splice connection is produced. This object is achieved by the features of Claim 51.

The slender in-line cable closure according to
35 the invention for the microcables described essentially comprises two sealing heads and a closure pipe. The sealing heads are interchangeably

graduated and optimized in their internal diameter for the different microcable diameters. The connection between the sealing heads and the end of the pipe of the microcable takes place by a crimping operation. In this operation, the soft material, in particular metal, of the concentric sealing head is permanently deformed and pressed onto the pipe of the microcable in a sealtight manner. To increase the sealing effect, the sealing heads may be provided with peripheral grooves in the crimping regions. The same effect can also be achieved if a plurality of crimpings are carried out in series one behind the other. Within the cable closure, thus a plurality of splices may be deposited together in one multi-fibre shrink splice protector. By exposure to heat, a sealing of the splices is created. For splicing, multi-fibre splicers known per se may be used, such as for example the splicer X120 from the RXS company. However, conventional thermal splicers may also be used for individual fibres, for example the device X75 from the RXS company. To avoid crossovers and loopings of the splices in the splice protector, the individual optical waveguides must be fixed on both sides of the splice protector by an adhesive tape. Preferably, a parallel alignment of the individual optical waveguides and their fastening takes place in a planar mounting for optical waveguides, such as are known per se. Finally, all the splices are to be sealed together with a splice protector. In cases of few fibres, a plurality of crimping splice protection parts may be used instead of the multi-fibre splice protector. The splices may be arranged in series one behind the other or else next to one another in the cable closure. In order that the closure pipe can be pushed over the splices without damaging the optical waveguides, the optical waveguides must be brought up to the splices, so that fastening to the splices is recommendable. The splicing operation is expediently performed on a workbench, on which the optical waveguide ends to be spliced are clamped in dividable fastenings. After the splicing operation, the splicer is removed again, for

- 21a -

example lowered into the workbench. Subsequently, the respective sealing head is pushed onto each

pipe end of the microcables and is fixed in a sealing manner over the entire periphery by crimping. For further assembly, one of the microcable fastenings is then removed and the closure pipe is pushed with the aid of a guide over the splices until the second sealing head is taken up by the closure pipe. The required excess length of optical waveguide within the closure is then achieved by displacing at least one closure head. For this purpose, the fastenings of the pipe ends of the microcables have to be displaced. Thereafter, both ends of the closure pipe are crimped by a crimping device, for example crimping pliers, radially onto the sealing heads. All the operations in the assembly device are provided with longitudinal stops, or at least visual markings, for reasons of better reproducibility.

Dividing optical waveguides between different branching cables can be achieved with specially designed sealing heads which are provided with a plurality of cable lead-throughs. The fixing and sealing at these cable lead-throughs, which takes place with cable lead-in spigots, is performed outside the cable closure by crimping. Alternatively, it is possible to dispense with crimping between the closure pipe and the closure head if, instead, the two parts are screwed to each other or fixed in a sealing manner by a shrink tube.

If required, the interior space in the cable closure may also be filled with filling compound. For this purpose, the closure pipe is provided with filling holes, which are closed for example by clamping rings or by a hot- or cold-shrink tube.

Thus, with a structural design according to the invention, the following advantages are obtained in comparison with the existing prior art.

- It is a slender, no longer openable cable closure of plastically deformable metal.

- The closure is stable with respect to transverse compressive stress, tension-resistant, torsionally rigid and pressure-watertight.

- Assembly of the cable closure, comprising few individual parts, is quick and easy.

- The metallic seals are pressure-watertight seals which are resistant to temperature and aging at the same time.

- The sealing does not involve any plastic or rubber seals, so that no flowing of materials occurs.

- Only a few, annular and concentric seals with a large sealing surface area are used.

- There are no longitudinal seals.

- A permanent, pressure-watertight optical-fibre cable/sealing head connection which is stable with respect to tensile, compressive and torsional forces is produced by crimping.

- A permanent, pressure-watertight sealing head/closure pipe connection is produced by crimping.

- The sealing heads consist, for example, of plastically deformable metal, for example copper, aluminium.

- Simple standard crimping pliers which have appropriate inserts and carry out the deformation plastically are adequate for the crimping operation.

- A plurality of crimpings in series one behind the other increase the sealtightness and pull-out force of the microcable ends.

- The sealing effect can be increased by peripheral grooves on the sealing head.

5 - On account of the small diameter, the cable closure may be laid in the axial direction of the microcables, so that a widening of the laying channel is adequate, the laying depth of the microcable likewise being adequate.

10 - The metallic closure pipe and the metallic sealing heads provide electrical through-connection of the microcable.

- The crimping of ductile copper microcables and of hard, resilient steel tubes is possible.

15 - The cable closure is resistant to buckling and consequently ensures that optical waveguide bending radii are maintained during laying.

- The sealing heads of the cable closure of different internal diameter are interchangeable, but have the same external diameters.

20 - The closure heads have in the longitudinal bore a length stop for the microcable, so that penetration of the microcable into the interior of the cable closure is prevented. The bores of the closure heads are bevelled and facilitate assembly during leading in of the microcables.

25 - This structural design provides a standard size of closure for all diameters of possible microcables.

- Due to the interchangeability of the sealing heads, connecting microcables of different external diameters is also possible.

30 - Microcables with a low number of optical waveguides and with a high number of

optical waveguides can be spliced with one another.

- A shrink splice protector allows a plurality of optical-fibre splices to be protected.

5 - Both individual optical waveguides and optical waveguide strips can be accommodated in the closure.

- Depending on the width of the closure pipe, the optical-fibre splices can be arranged in series one behind the other or else next to one another.

10 - Standard tools can be used for the splicing, such as a splice protector and thermal splicer for optical waveguides.

- The length of the closure allows excess lengths of optical waveguide to be accommodated adequately on both sides of the optical-fibre splices.

15 - The optical-fibre splices are freely movable within the cable closure.

The following can be used, for example, as deformable materials: copper, copper-based wrought alloys, aluminium, cold-workable aluminium alloys or
20 plastically deformable, non-hardened, stainless steel.

Furthermore, the sealing between the sealing-head outer casing and the closure pipe and/or between the sealing-head bore and the pipe end of the microcable may alternatively also take place by a cutting-clamping
25 connection, as is known per se from sanitary installation engineering. The cutting rings used for this purpose are plastically deformed by union nuts and thereby seal off the concentric, tubular closure parts from one another. For this purpose, however, internal

and external threads have to be provided on the corresponding sealing heads.

In Figure 22, a slender cable closure KM is represented in longitudinal section as an in-line closure for two microcables MK1 and MK2 with protective splices SS lying in series one behind the other in the interior of the cable closure KM. A plurality of individual optical-fibre splices are brought together and protected together in a multiple splice protector SS. On both sides of the protective splices SS there is adequate free pipe length in order to accommodate the excess lengths of optical waveguide LU1 and LU2, respectively. The protective splices SS are freely movable within the cable closure KM. The ends of the pipes of the microcables MK1 and MK2 are fixed in a sealtight manner by crimping at the crimping points KRK of the two sealing heads DK1 and DK2, the required tensional, torsional and compressive strength being achieved at the same time. The closure pipe MR1 pushed over the two sealing heads is crimped onto the two sealing heads DK1 and DK2 and closed in a pressure-watertight manner on both sides at the crimping points KRM. The individual optical waveguides are fixed with the aid of fixings F in the region of the protective splices to the latter in order to facilitate the assembly of the closure pipe MR1. In this case, the ends MKE1 and MKE2 of the pipes of the microcables MK1 and MK2, respectively, are led through the respective sealing head DK1 or DK2 into the interior of the closure.

Represented in Figure 23 is a sealing head DK, which has an inner bore BDK, the diameter of which is matched to the microcable to be respectively fed in. At the inner end of this bore BDK there is a stop AS for the led-in cable. At the inlet of the bore BDK, the edge of the bore is provided with a bevel AF, in order to facilitate the leading in of the microcable. On the outer surface of the sealing head DK, peripheral sealing grooves may be arranged, by which the sealing effect is improved.

Figure 24 shows a cross-section through the cable closure in the splice region of the closure pipe MR1. Within a protective splice SS, of which a plurality are arranged in series one behind the other in this exemplary embodiment, there are a plurality of optical waveguide splices LS, which are fixed next to one another. Such a splice protector is, finally, also provided with a fixing F, by which the excess lengths of optical waveguide LU led past are loosely held in the closure space.

Figure 25 illustrates that a plurality of splice protection units SS, with the optical-fibre splices LS contained therein, may be arranged next to one another, although then the cross-section of the closure pipe MR2 has to be greater than in the case of the exemplary embodiment according to Figure 3.

In Figure 26, the cable closure KM is designed as a branch cable closure, here too sealing heads DK3 and DK4 being used, onto which the closure pipe MR2 is crimped in a secure and sealtight manner at the crimping points KRMR. In the case of this exemplary embodiment, there are additionally provided filling openings EF, which can be closed with the aid of sealing tapes DB. Arranged in the sealing heads DK3 and DK4 are cable lead-in spigots KES1 to KES4, which correspond to the sealing heads DK1 and DK2 of the previously described in-line cable closure, that is to say they too are of plastically deformable material and serve for the sealtight connection of the microcables MK3 to MK6. At the crimping points KRK of the cable lead-in spigots KES1-KES4, inserted into the lead-in bores EB of the sealing head DK3 and DK4, respectively, the mechanical supporting and sealing off of the led-in microcables MK1-MK4 takes place. Contained in the interior of the cable closure are the protective splices SS, in which the individual optical-fibre splices are accommodated in groups.

Figure 27 finally shows an assembly arrangement for the assembly of the cable closure according to the invention once the

splicing work has been carried out with the aid of a splicer SPG. On both sides of the splicer SPG there are removable fixings FMK1 and FMK2, respectively, for the fixing of the respective microcables MK1 and MK2 to be
5 connected. The sealing heads DK1 and DK2 of the cable closure to be assembled are pushed onto the ends of the microcables MK1 and MK2, respectively, and fixed by crimping. Beforehand, however, the closure pipe MR1 has been pushed over the microcable MK1 and fixed. Once the
10 splicing work with the aid of the splicer SPG has then been completed, the fixing FMK1 at the sealing head DK1 is released and removed. As a result, the closure pipe MR1 previously pushed on and fixed for assembly can be pushed in the direction of the indicated arrow PFMR over
15 the two sealing bodies DK1 and DK2. By corresponding displacement of the sealing bodies DK1 and DK2, respectively, the excess lengths LU1 and LU2 contained in the interior can then be formed. Subsequently, the closure pipe MF1 is fixed in a sealing manner onto the sealing
20 heads DK1 and DK2 by crimping.

The invention relates to a method of connecting a microcable comprising a pipe with led-in optical waveguides, which has been introduced into a laying channel in solid laying ground, to an existing optical-
25 fibre transmission system of a conventional type.

Optical-fibre transmission systems comprising optical-fibre cables known per se are sufficiently known and already laid, subsections being coupled together by the conventional connection units. However, the optical-
30 fibre transmission system comprising tubular microcables, which comprise homogeneous and pressure-watertight pipes into which optical waveguides are introduced, cannot be connected in the previously customary way to an existing optical waveguide system, since the microcables differ
35 considerably in structural design and in the type of laying from the conventional optical-fibre cables.

Furthermore, it is the object of a development of the invention to find methods of connecting a microcable with the aid of cable closures of the type described to conventional optical-fibre transmission systems, it being
5 intended for the connection to take place in the same laying ground or in laying grounds of different types of construction. The object set is then achieved with the aid of a method of the type explained at the beginning, when joining together in the same laying ground with
10 cable closures, by the microcable being led into an adapter closure, for receiving microcables, through a cable lead-in of a manhole of the existing optical-fibre transmission system which has been made in the same laying ground, by optical waveguides of a flexible cross-
15 connecting cable being spliced onto the optical waveguides of the microcable within the adapter closure and by the cross-connecting cable being led into a conventional splicing closure for optical waveguides for connection to the optical cables of the existing optical-
20 fibre transmission system, the joining together being performed within the splicing closure.

Furthermore, the object set is also achieved with the aid of a method of the type explained at the beginning, when joining together in different laying grounds,
25 by the microcable being led at the end of the solid laying ground into an adapter closure at the height of the laying channel and spliced onto a buried cable, by the buried cable being laid in the earth at the height of the leading-in level of the manhole made in the earth,
30 led into the manhole and spliced there within a splicing closure onto the existing optical-fibre network.

With the aid of the method according to the development of the invention, it is then possible to couple an optical-fibre transmission system made up of
35 microcables to an optical-fibre transmission system with conventional optical-fibre cables. The coupling of tubular microcables

5 onto the existing network in this case takes place with
cable closures of which the cable lead-ins are designed
for the requirements of the microcables. Used for this
purpose are cable closures of metal of which the spigot-
shaped cable inlets are crimped onto the pipes of the
microcables. This method is not possible with the aid of
conventional cable closures. From such an adapter closure,
a cross-connecting cable of a conventional type is then
led to a conventional splicing closure, into which the
10 conventional optical-fibre cables are also led in. There,
the splicing of the optical waveguides of the microcable,
or of the cross-connecting cable, with the optical wave-
guides of the conventional optical cables is performed.
This has the advantage that the tubular microcable ends
15 in a special adapter closure, from which a flexible
optical-fibre cable is led into a conventional splicing
closure, where any service work can then be performed. In
this case, the microcable, which is susceptible to
buckling, can be rigidly fixed on the manhole wall, so
20 that any buckling of the pipe can be ruled out. In the
conventional splicing closure, on the other hand, cross-
connecting excess lengths of fibres for subsequent splic-
ing and all the splices can be accommodated. In the adap-
ter closure itself, only the microcable is accommodated
25 and connected to the flexible cross-connecting cable.

If a special adapter closure cannot be used, the
microcable must be led directly into the splicing closure
by special measures, corresponding protective measures
having to be taken for the pipe which is susceptible to
30 buckling. Suitable for this purpose is, for example, a
tube which is stable with respect to transverse
compressive stress and protects the metal pipe of the
microcable against buckling and damage. The protective
tube also makes the microcable much thicker, so that it
35 can be identified better in the manhole.

Access to an already existing manhole, in which
optical cables of a conventional type have already been
led in, is achieved by the laying channel in which the
microcable

is laid being cut into the solid laying ground in the direct vicinity of the manhole. The normal laying depth of such a route is 70 to 150 mm. From the road surface, a core hole is then made up to the route of the micro-
5 cable on the outer wall of the manhole. Subsequently, the manhole wall is drilled through in the upper manhole region and the microcable is led in from outside. The core hole made outside the manhole in this case serves as a leading-in aid, to compensate for laying inaccuracies
10 and for receiving the loop of excess length of cable of the microcable as well as for sealing off the manhole from the outside. The manhole is sealed off by a conventional masonry lead-through, such as for example with lead-through seals known per se for manholes. In the
15 interior of the manhole, the microcable is then led horizontally along the manhole wall up to the adapter closure.

If the manhole for the conventional optical-fibre systems is not made in the solid laying ground in which
20 the microcable runs, difficulties arise in bringing the microcable up to the manhole; this is because the relatively rigid microcable could, for example, be sheared off. In such cases, there is then placed at the end of the laying channel in the solid laying ground, for
25 example of a road surfacing, an adapter closure, into which the microcable is led. Here there is then spliced on a flexible buried cable, which is laid at a deeper laying level in the earth up to the leading in of the manhole. Here, the splicing onto the existing network
30 then takes place in a splicing closure.

The leading into a manhole also opens up the possibility that microcables laid at different heights can be brought together.

The following special features and advantages of
35 the method are obtained according to the invention:

- The customary optical waveguide assembly technique can be retained.

- The bringing together of the new and old optical-fibre systems can take place in already conventional optical waveguide accessories.

- The small laying depth of the microcable allows the existing free space in the upper manhole region also to be used.

- A core hole on the outer wall of the manhole suffices for leading in the microcable, so that no excavation of the surrounding earth is necessary.

- In such a way, routes having different laying heights can be brought together.

The manhole 103 shown in Figure 28, which is arranged below the road surface 101 of the laying ground 102 and is covered by a cover 114, contains first of all an optical-fibre transmission system 104 comprising conventional optical-fibre cables. Already provided in this system is a conventional splicing closure 113, excess lengths 112 of optical-fibre cable introduced in the customary way allowing a certain mobility of the splicing closure for splicing work. These optical cables of the conventional system 104 are usually in ducts and are led in via lead-in seals 106 relatively deep in the lower region of the manhole. By contrast, the newly added microcable 105, comprising a pipe and optical waveguides guided therein, is led into the manhole 103 via a cable lead-in 107 in the upper region of the manhole, since the laying channel has only a depth of 70 to 150 mm. For this purpose, a core hole 108 is introduced outside the manhole 103, in order to have sufficient free space for leading in the microcable.

Into this core hole 108 there may also be introduced, for example, a tubular excess length of the microcable 105, with which it is possible to compensate for tolerances in length. After introducing the microcable 105, the laying channel is filled with a filling compound 115, such as for example bitumen. Within the manhole 103, the led-in microcable 105 is initially mechanically protected and supported with the aid of a protective tube or protective pipe 109 and is subsequently led into an adapter closure 110, which is suitable for the leading in of microcables. In this adapter closure 110, the optical waveguides are connected to a flexible cross-connecting cable 111. After leaving the adapter closure 110, this flexible cross-connecting cable 111 is then led into the splicing closure 113 of the already existing optical-fibre transmission system and coupled to it via optical-fibre splices. The flexible cross-connecting cable 111 is also deposited in the manhole with corresponding excess lengths 112, so that, even after the cross-connecting cable has been led in, removal of the splicing closure 113 from the shaft for service work is possible.

Figure 29 shows an exemplary embodiment of the procedure when the manhole is not in the region of the solid laying ground in which the microcable is laid, but is in the neighbouring, relatively soft earth. The relatively rigid microcable could be damaged in the transitional region. Thus, if the manhole 103 is in the earth 123, the microcable 117 can be laid only up to the end of the solid laying ground, for example the carriage-way 116. From there, a buried cable 124 has to be led to the cable lead-through 125 of the manhole. The standard laying depth is about 60 to 70 cm in the earth. The difference in height can be overcome with an adapter closure 120. The microcable 117 is led in and sealed off in the upper region by the lead-in 118. The buried cable 124 is led through a spigot 121 and sealed off, for example by a shrink tube piece 122. For leading into the

manhole 103, the buried cable 124 has to be buried in the ground and the outer wall of the manhole 103 has to be exposed. Within the manhole 103, the buried cable is then led into the splicing closure installed there, where the optical waveguides are connected.

During the laying of microcables, which comprise a pipe and optical waveguides loosely introduced therein, it is necessary to arrange excess lengths of cable before branches, closures or after relatively long sections of cable, in order to make required compensations of lengths possible. Such settlements, elongations and also temperature-induced changes in length during the interaction of materials with different coefficients of thermal expansion are compensated by so-called elongation loops. During laying in laying channels which are made in solid laying ground, these elongation loops have until now been made vertically in correspondingly sunken laying channels, perpendicularly with respect to the surface of the laying ground. This leads to difficulties, however, if the laying ground, such as for example a carriageway surfacing, is not sufficiently thick.

A further object of the invention is thus to provide a protective device for terminating core holes in which the elongation loops of microcables are horizontally laid. The object set is achieved with a protective device of the type explained at the beginning by the said device comprising a protective cover and a driving-in peg, provided centrally at one end, for fixing in a central hole at the bottom of the core hole, by the diameter of the protective cover corresponding to the diameter of the core hole and by filling material being arranged above the protective cover for sealtight termination and for filling the remaining core hole.

The advantage of protective devices according to the invention is that elongation loops of microcables can be horizontally laid or formed into core

holes which have a diameter which corresponds at least to the minimum permissible bending radius of a microcable, since the possible mechanical loading is absorbed by it and since such a termination also has the necessary
5 sealtightness. Furthermore, it is of advantage that now the core holes are only required to be of a small depth, so that breaking through the solid laying ground, such as for example the subgrade of a carriageway, can no longer occur. Such an intervention to the mechanics of the solid
10 laying ground, for example a road surfacing, is consequently uncritical. The required diameter for such a core hole is of the order of magnitude of 150 mm, so that these core holes can still be made with conventional machine tools without any problem. Consequently, the same
15 tool can be used to produce core holes for elongation loops, cable branches or setting holes for cylindrical cable closures, as are customary in the use of micro-cables.

The protective device according to the invention
20 comprises a more or less mushroom-shaped mounting, which is inserted into the core hole of the solid laying ground and upwardly covers the latter such that the original strength of the laying ground, for example the surfacing for road traffic, is restored. Within the core hole, the
25 coiled-up excess length or elongation loop of the micro-cable is held down. In addition, the core hole is sealed off with respect to the surface of the solid laying ground and the microcable is protected against mechanical loading from above. This problem is particularly impor-
30 tant if, due to elevated climatic conditions, for example in the case of a temperature rise above 30°C, the bitumen of the road surfacing softens and the mechanical load-bearing capability is reduced. For example, in high summer, even in our temperate zones, temperatures of over
35 60°C are measured in the asphalt. The hollow space of the core hole, in which the elongation loop is located, may be filled with a filling material,

which must not, however, restrict the mobility of the microcable. The protective device upwardly terminates the core hole and the region thereabove is sealed with hot bitumen. Additions of solid material such as chippings increase the strength of the cast bitumen, so that in this way something approaching the strength of the asphalt is achieved.

Represented in Figure 30 is a core hole KB in solid laying ground VG, in which two laying channels VN1 and VN2 run in tangentially. The core hole KB has a diameter which is adequate for receiving the excess length or elongation loop DS of a microcable MK in horizontal position for the range of elongation to be expected. A central hole ZB serves for receiving and arresting the protective device according to the invention. The hollow space of the core hole KB may, if required, be filled with a filler, which must not, however, significantly influence the mobility of the elongation loop DS. The laying channels may be led into the core hole at different angles of offset, so that virtually any angling off can be carried out for the further running of a laying route. In addition to the central hole ZB, further holes may be made in the laying ground, serving for example as an outflow for condensed water in the core hole KB or one of the laying channels VN1 or VN2. When laying in the elongation loop DS, it must be ensured that the microcable MK does not touch the wall of the core hole, so that during any elongation the laid-in microcable can also give way outwards. Consequently, compressive stresses in the microcable are reduced without compression occurring and without risking buckling. When shortening the microcable, the elongation loop may be pulled together without the cable being subjected to tensile stress. In this figure, a deflection of the microcable MK of 90° is shown, the excess length or elongation loop DS then being stored in a 450° loop. Such an arrangement may be used irrespective of the inlet or outlet angles for deflecting a route or

else as an ancillary means ahead of a following cable closure.

5 Figure 31 shows in a sectional representation through the core hole KB the position of the elongation loop BS of a microcable MK and the mushroom-shaped protective device, comprising the protective cover SD and a driving-in peg ES, which has, for example, in the region of the elongation loop DS as a minimum diameter limitation ESB a diameter which corresponds to the
10 minimum permissible bending radius of the led-in cable MK. In this way, there is no risk that the microcable K could be excessively bent or buckled. The free space above the protective cover SD is filled with a filler FM, preferably a hot bitumen, whereby a sealing of the core hole KB takes place. If hot bitumen is used, a mixture with chippings SP is expedient, since in this way an adaptation to the road surfacing SO can be achieved. Furthermore, it is shown in this Figure 31 that a pulling eyelet ZO may be provided for lifting the protective
15 cover SD. The protective device according to the invention may, however, also be of a multipart configuration, the driving-in peg ES then expediently having in the upward direction a receiving pin AS, onto which the protective cover SD can be placed or screwed. The diameter limitation ESB lying thereunder in this case forms a peripheral rest for the protective cover ESD. The diameter limitation ESB may also be fitted on as an extra part in the form of a sleeve. With the driving-in peg ES, the entire device is fixed in a central hole in the
20 laying ground within the core hole KB by driving in.

To sum up, further special advantages of the protective device are listed:

It is a temperature-independent protective device for core holes, since the protective cover compensates
35 for the differences in heat in the asphalt and dissipates the heat via the peg

into the earth. As a result, there is also no settling or flowing of the asphalt above the protective cover.

5 The elongation loop of the microcable can move freely underneath the protective cover, to be precise even if loose fillers, such as stone chips, bitumen, prefabricated profiles of polystyrene or one-component foam, are filled in. Consequently, the hollow space is largely protected against the formation of condensed water, since a seepage of any condensed water occurring
10 is also ensured by additional holes in the core hole, which reach into the frost blanket of the laying ground.

The protective cover absorbs the loading from above and directs it via the driving-in peg into the solid laying ground. As a result, high permanent loading
15 is possible without subsidence. The same applies in the case of high area loading or else in the case of punctiform loading, as may be caused by tyres of vehicles or by sharp objects such as props, tools, chisels, knives, pins or stiletto heels.

20 If a large elongation length is required, a correspondingly large core hole may be made, it being possible for the radii of the elongation loops to be formed simply and without a tool. Buckling is in this case scarcely possible.

25 The surface of the protective cover may be roughened, in order that better adhesion with respect to the cast material is achieved.

It is also ensured by the protective cover that the elongation loop does not spill out or move out
30 upwards when an elongation operation is proceeding.

The filling of the hollow space of the core hole above the protective cover ensures that, when the road surfacing is renewed, only the filler above the protective cover

is cut away and renewed, so that the protective device remains unaffected by this.

5 A further object of the invention is to provide a cable closure for optical waveguides which is fitted in solid laying ground, is accessible from above and has leading-in possibilities for deeply laid cables. The object set is then achieved with the aid of a cable closure of the type explained at the beginning, by the cable closure comprising an outer body which can with-stand high mechanical loads and a cable-closure sealing body fitted in the outer body, by the outer body having a removable outer cover, which is at the same height as the surface of the laying ground, by the cable-closure sealing body lying thereunder being closed off by an upwardly removable sealing cover, by cable connection units in pipe form being led in from below through the outer body into the cable-closure sealing body and by the ends of the cables being led into these cable connection units and sealed off.

20 The cable closure according to the invention is an upwardly accessible closure, making it possible for splicing and cross-connecting work and also lining up of fibres or twin copper wires to be performed without exposing the closure. Until now, fibres and twin copper wires of local and connecting cables have been accessible only if the entire closure is exposed and the closure body is removed. At the same time, the closures are usually at the same laying height as the cables. Digging work is, however, usually laborious, so that much time is additionally taken up for the repair and service work to be carried out. In the case of the work to be performed according to the invention, there is no need for digging work, since the upper side of the closure terminates flush with the surface of the laying ground. Such a closure is suitable in particular for leading in micro-cables, which are arranged at a relatively small depth in laying channels of solid laying ground. In addition, in the case of the cable closure according to the invention,

there is also the possibility of leading in standard buried cables, which usually run at a greater laying depth. Provided for this purpose are cable connection units, which are led into the cable closure from below, the leading-in height of these cable connection units being adapted to the laying height of the buried cables. In this way, even deeper laid buried cables can be reached from the surface of the laying ground without special measures, such as digging work, being necessary.

Such cable closures may be used as branch cable closures and/or in-line cable closures in local and branching networks. This is particularly favourable, since switching and cross-connecting work is recurrently necessary in the local network. On account of the simple structural design of the cable closure according to the invention, it may be used in an uncomplicated way in footpaths, pavements and cycle paths, in particular in urban areas. All that is required for this purpose are paved squares, roads or paths, the load-withstanding cover simply having to be removed for access to the cable closure, in order to gain access to the fibres or twin wires from the surface. If the cable closure according to the invention is used, special advantages with respect to systematic utilization of the existing infrastructure are then obtained on account of the compact structural design and the good accessibility.

In the configuration according to the invention, the mechanical loads are absorbed by the outer body, which preferably consists of grey cast iron, while the cable-closure sealing body in the interior of this outer body can be closed in a sealtight manner and contains the individual communication parts. The sealing cover and the outer cover are expediently secured against unauthorized opening and, if appropriate, can be locked. Overall, the outer body can withstand high mechanical loads up to a bridge class of 30 and more, so that the cable-closure sealing body has to meet only the conditions with respect to sealtightness. The hollow space between the outer body

and the cable-closure sealing body may expediently be filled or plugged with a filler, so that the two bodies are connected to each other in a dirt- and watertight manner as a unit. The closure sealing body is pressure-
5 watertight and can be sealed off well and consists of plastic, diecast materials or metal. For fastening, there is preferably provided a sealing cover, the fastening mechanism of which is designed as a turn-lock or bayonet fastener. Such a closure may also be built at a later
10 time into existing routes of pavements and cycle paths, since the design means that it can fit in well with the local conditions. The structural design of the cable closure also allows further cables to be led in at a later time if cable connection units were additionally
15 provided at the beginning. For easy identification, the cable closure can, because of its easy accessibility, be easily assigned by labelling or coding, so that there is no need for laborious search and coordination measures.

Figure 32 shows the upwardly accessible cable
20 closure KMO according to the invention, which comprises the outer body AK, which can withstand high mechanical loading, and the inner cable-closure sealing body KDK. The outer body AK terminates with respect to the laying ground VG below with a standing flange STF and upwardly
25 with a peripheral collar KR. Fitted within the collar KR is the outer cover AD, which can be lifted up along a pivot pin DA and swung out to the side, so that the sealing cover DD of the cable-closure sealing body KDK lying thereunder is then accessible. This sealing cover
30 DD seals off the cable-closure sealing body KDK via a round seal RD and with the aid of a fastener, preferably a bayonet fastener BV. The intermediate space between the outer body AK and the cable-closure sealing body KDK is filled here with a filler, for example a plastics foam
35 FS. The cable-closure sealing body KDK is held centrally in the outer body AK by a spacer AH and the supporting flange AF for the outer cover. The surface of the laying ground VG,

for example a road surface SO, terminates flush with the surface of the outer cover AD, so that a stepless transition is ensured. Shown in the interior of the cable-closure sealing body KDK is a splice organizer SK, on which the led-in optical waveguides LWL are spliced. After opening the outer cover and sealing cover, this splice organizer SK is accessible from above, without the cable closure having to be removed. Because of the excess lengths of optical waveguide, the splice organizer SK can, however, be pulled out for service work. The cables K or else microcables MK are led in through the cable connection units KA connected downwardly onto the cable closure KMO, these cable connection units KA being angled off, or bent off, at the laying height of the cables K or MK, so that the leading in can take place without buckling. The sealing between the cable K and a cable connection unit KA may be performed, for example, with the aid of a shrink tube piece SS. The sealing between a microcable MK, which comprises a pipe with introduced optical waveguides, takes place, for example, with the aid of a peripheral crimp connection KV.

In the case of this cable closure according to the invention, however, there may also be provided additional cable connection units from the side in the upper region of the side wall of the cable closure KMO, which units are then usually used for feeding in microcables lying less deep, as already described. However, this is not drawn in here. Such lead-ins may take place radially or tangentially.

Consequently, depending on the type of structural design and laying depth, cables can be brought together in a cable closure, all the cable ends and the associated terminations then being effortlessly accessible from above, without the cable closure itself having to be dug out.

If the static loading, for example in the foot-path region, is only low, it is possible to dispense with the outer body. The removable

or pivotable outer cover is then provided directly on the closure sealing body.

New Patent Claims

(replace the original Patent Claims 1 to 71 on the original pages 44-58)

1. Optical-fibre transmission system comprising a
5 cable closure for optical waveguides with splice
organizers and excess-length depositories for excess
lengths of optical waveguide and comprising at least one
optical-fibre cable, cable lead-in units in the form of
10 cable lead-in spigots being arranged into the cable
closure perpendicularly with respect to the axis of the
closure body of the cable closure, the excess lengths of
optical waveguide and the splice organizers being
arranged within the closure body removably in the axial
15 direction of the closure body, and at least one end face
of the closure body being closed off in a sealing manner
by an externally accessible cover, characterized in that
the cable lead-in units are designed as lead-in spigots
(13) in the form of pipes (45, 46) tightly fitted on, in
20 that the optical-fibre cables (10) in the form of optical
waveguide minicables or optical waveguide microcables,
respectively comprising a pipe (8, 9, 15) and optical
waveguides (12), optical waveguide strips or optical
waveguide bundles loosely introduced therein, are
25 arranged in the cable lead-in units (13, 17 - 18, 45, 46,
56, 70) designed in terms of pipe connecting technology
for receiving and sealing off the pipes (8, 9, 15) of the
optical-fibre cables (10), the sealing connection of the
pipe connecting technology being a welded, soldered or
30 adhesively bonded connection between the pipe (8, 9, 15)
of the optical-fibre cable (10) and the cable lead-in
unit (13).

2. Optical-fibre transmission system comprising a cable closure for optical waveguides with splice organizers and excess-length depositories for excess lengths of optical waveguide and comprising at least one
5 optical-fibre cable, cable lead-in units in the form of cable lead-in spigots being arranged into the cable closure perpendicularly with respect to the axis of the closure body of the cable closure, the excess lengths of optical waveguide and the splice organizers being
10 arranged within the closure body removably in the axial direction of the closure body, and at least one end face of the closure body being closed off in a sealing manner by an externally accessible cover, characterized in that the cable lead-in units are designed as lead-in spigots
15 (13) in the form of pipes (45, 46) tightly fitted on, in that the optical-fibre cables (10) in the form of optical waveguide minicables or optical waveguide microcables, respectively comprising a pipe (8, 9, 15) and optical waveguides (12), optical waveguide strips or optical
20 waveguide bundles loosely introduced therein, are arranged in the cable lead-in units (13, 17 - 18, 45, 46, 56, 70) designed in terms of pipe connecting technology for receiving and sealing off the pipes (8, 9, 15) of the optical-fibre cables (10), the sealing connection of the
25 pipe connecting technology being a press connection with sealing means and a pressing element with a union nut, between the pipe (8, 9, 15) of the optical-fibre cable (10) and the cable lead-in unit (13).

3. Optical-fibre transmission system comprising a
30 cable closure for optical waveguides with splice organizers and excess-length depositories for excess lengths of optical waveguide and comprising at least one optical-fibre cable, cable lead-in units in the form of cable lead-in spigots being arranged into the cable
35 closure perpendicularly with respect to the axis of the closure body of the cable closure, the excess lengths of

at least one end face of the closure body being closed off in a sealing manner by an externally accessible cover, characterized in that the cable lead-in units are designed as lead-in spigots (13) in the form of pipes (45, 46) tightly fitted on, in that the optical-fibre cables (10) in the form of optical waveguide minicables or optical waveguide microcables, respectively comprising a pipe (8, 9, 15) and optical waveguides (12), optical waveguide strips or optical waveguide bundles loosely introduced therein, are arranged in the cable lead-in units (13, 17 - 18, 45, 46, 56, 70) designed in terms of pipe connecting technology for receiving and sealing off the pipes (8, 9, 15) of the optical-fibre cables (10), the sealing connection of the pipe connecting technology being a plastic crimped connection (58, 89) or a permanently elastic, annular seal between the pipe (8, 9, 15) of the optical-fibre cable (10) and the cable lead-in unit (13).

4. Optical-fibre transmission system according to Claim 1, characterized in that the closure body (5, 44) has a cylindrical shape.

5. Optical-fibre transmission system according to Claim 1, characterized in that the closure body has an oval shape.

6. Optical-fibre transmission system according to one of Claims 1 to 5, characterized in that the lead-in spigots (13) are led in tangentially at the wall of the closure of the closure body (5, 44).

7. Optical-fibre transmission system according to one of Claims 1 to 5, characterized in that

the lead-in spigots (13) are led in radially at the wall of the closure of the closure body (5, 44).

8. Optical-fibre transmission system according to one of the preceding claims, characterized in that the
5 cable lead-in units (13) for the inlet direction and outlet direction lie on the same level.

9. Optical-fibre transmission system according to one of Claims 1 to 8, characterized in that the cable lead-in units (13) for the inlet direction and outlet
10 direction lie at different levels.

10. Optical-fibre transmission system according to one of the preceding claims, characterized in that the cable lead-in units (13) point in the same direction.

11. Optical-fibre transmission system according to one of Claims 1 to 9, characterized in that the cable lead-in units (13) point in different directions.
15

12. Optical-fibre transmission system according to one of the preceding claims, characterized in that the excess lengths of optical waveguide (24) are arranged circular up against the inner wall of the closure body
20 (5).

13. Optical-fibre transmission system according to one of the preceding claims, characterized in that

the excess lengths of optical waveguide (30, 38) are arranged in groups at different levels in the closure body (5).

14. Optical-fibre transmission system according to one of the preceding claims, characterized in that the excess lengths are protected by a flexible buckle-resistant tube (54), which is deposited in a plurality of loops, maintaining the minimum bending radius, in the inner closure body.

15. Optical-fibre transmission system according to Claim 3, characterized in that a plastically deformable soft-metal tube (87) is used for the crimped connection between the microcable and the cable lead-in unit (13).

16. Optical-fibre transmission system according to one of the preceding claims, characterized in that a compensation loop (47) of the pipe of the optical-fibre cable (10) is arranged ahead of the lead-in into a cable lead-in unit (13).

17. Optical-fibre transmission system according to Claim 16, characterized in that the compensation loop (47) is arranged as an attachment to the cable lead-in unit (13).

18. Optical-fibre transmission system according to one of the preceding claims, characterized in that the closure housing (5, 44) and the cover (20, 73, 74) are designed to withstand high mechanical loading for fitting into a drilled core hole of a laying route in the ground, preferably in a road surfacing.

19. Optical-fibre transmission system according to one of the preceding claims, characterized in that the cable lead-in units (13) for triple branches are fitted in a T-shape on the closure housing (5, 44).

5 20. Optical-fibre transmission system according to one of Claims 1 to 18, characterized in that cable lead-in units (13) for quadruple branches are fitted in a cross shape on the closure housing (5, 44).

10 21. Optical-fibre transmission system according to one of the previously specified claims, characterized in that the lead-in openings of the cable lead-in units (13) are designed in a funnel shape and preferably have a length stop for the microcable (10).

15 22. Optical-fibre transmission system according to one of the preceding claims, characterized in that the cable closure (61) is arranged in a protective housing (64), the protective housing (64) having lead-through openings (63) for the optical-fibre cables (62) and in that the intermediate space between the cable closure (61) and the inner wall of the protective housing (64) is
20 filled, preferably with a flexible foam filling (66) of plastic.

23. Optical-fibre transmission system according to Claim 22, characterized in that the protective housing
25 (64) consists of concrete and has a removable, load-bearing cover (68).

24. Optical-fibre transmission system according to one of the preceding claims, characterized in that

the diameter of the cable closure is 70 to 100 mm and the height is 150 to 250 mm.

25. Optical-fibre transmission system comprising a cable closure for optical waveguides with splice
5 organizers and excess-length depositories for excess lengths of optical waveguide and comprising at least one optical-fibre cable, cable lead-in units of the cable closure being arranged in the axial direction of the closure body of the cable closure, characterized in that
10 the cable closure (1, 2, 1a, 1b) comprises an extended closure pipe (19), in that the closure pipe (19) is adapted at the ends to the diameter of the pipe of the optical-fibre cable (8, 9, 10, 15), in that the leading in of the pipes of the optical-fibre cables takes place
15 in the axial direction of the closure pipe (19) and in that the seals between the closure pipe (19) and the optical-fibre cables (8, 9, 10, 15) take place in cable lead-in units (17 - 18) adapted in terms of pipe connecting technology to the diameters of the optical-fibre
20 cables, the sealing connection of the cable lead-in unit (17 - 18) in terms of pipe connecting technology comprising peripheral press seals.

26. Optical-fibre transmission system comprising a cable closure for optical waveguides with splice
25 organizers and excess-length depositories for excess lengths of optical waveguide and comprising at least one optical-fibre cable, cable lead-in units of the cable closure being arranged in the axial direction of the closure body of the cable closure, characterized in that
30 the cable closure (1, 2, 1a, 1b) comprises an extended closure pipe (19), in that the closure pipe (19) is adapted at the ends to the diameter of the pipe of the optical-fibre cable (8, 9, 10, 15), in that the leading in of the pipes of the optical-fibre cables takes place
35 in the axial direction of the closure pipe (19) and in that the

seals between the closure pipe (19) and the optical-fibre cables (8, 9, 10, 15) take place in cable lead-in units (17 - 18) adapted in terms of pipe connecting technology to the diameters of the optical-fibre cables, and the ends of the extended closure pipe (19) are provided in terms of pipe connecting technology with an external thread, in that the seals are formed by union nuts (17 - 18) and elastic sealing inserts (14).

27. Optical-fibre transmission system comprising a cable closure for optical waveguides with splice organizers and excess-length depositories for excess lengths of optical waveguide and comprising at least one optical-fibre cable, cable lead-in units of the cable closure being arranged in the axial direction of the closure body of the cable closure, characterized in that the cable closure (1, 2, 1a) 1b) comprises an extended closure pipe (19), in that the closure pipe (19) is adapted at the ends to the diameter of the pipe of the optical-fibre cable (8, 9, 10, 15), in that the leading in of the pipes of the optical-fibre cables takes place in the axial direction of the closure pipe (19) and in that the seals between the closure pipe (19) and the optical-fibre cables (8, 9, 10, 15) take place in cable lead-in units (17 - 18) adapted in terms of pipe connecting technology to the diameters of the optical-fibre cables, and in that the seals at the ends of the extended closure pipe (19, KM) are formed in terms of pipe connecting technology by crimped connections (87).

28. Optical-fibre transmission system according to one of Claims 25 to 27, characterized in that the ends of the extended closure pipe of the cable closure (2) have different diameters for adaptation to different diameters of pipes of various optical-fibre cables (9, 15).

29. Optical-fibre transmission system according to one of Claims 25 to 27, characterized in that the cable closure comprises a plurality of rings (33, 35) which can be placed closely against one another.

5 30. Optical-fibre transmission system according to one of Claims 25 to 37, characterized in that the closure body (33 - 35), or the extended closure pipe (19), is longitudinally divided, preferably in the plane of the cable lead-in units (13, 36).

10 31. Optical-fibre transmission system according to Claim 2 or 25, characterized in that cutting rings are arranged in the cable lead-in units (13).

32. Optical-fibre transmission system according to Claim 29, characterized in that sealing systems are
15 incorporated in the separating planes between the individual rings (33, 35).

33. Optical-fibre transmission system according to Claim 29, characterized in that cable lead-in units (13) are arranged in the separating planes between the
20 individual rings (33, 35) or sections.

34. Optical-fibre transmission system according to one of the preceding claims, characterized in that the interior space of the cable closure (5) is subdivided by separating plates (29) into a plurality of sections.

35. Optical-fibre transmission system according to one of Claims 1 to 3, characterized in that the cable closure has two covers (68, 73, 76, 80), arranged one above the other, the inner cover (73) sealing and the
5 outer cover (68, 76, 80) absorbing mechanical loads.

36. Optical-fibre transmission system according to one of Claims 3 or 27, characterized in that the crimped connection protects the tubular microcable (1) at the cable lead-in of the cable closure against tensile,
10 compressive and torsional stress.

37. Optical-fibre transmission system according to one of Claims 16 or 17, characterized in that differences in the elongation of the microcable (10) with respect to the surrounding bitumen can be compensated by compensa-
15 tion loops (47).

38. Optical-fibre transmission system according to one of Claims 3, 27, 36 or 37, characterized in that the complete cable closure, comprising closure body, cover, splice organizer, protective tube, cable lead-in units, sealing systems, crimped connections and compensation
20 loops, is prefabricated at the factory.

39. Optical-fibre transmission system according to one of Claims 2 or 26, characterized in that cold- or hot-shrink tubes, O-rings, annular lip seals or
25 permanently elastic seals may be used for an elastic sealing.

40. Optical-fibre transmission system according to Claim 27, characterized in that sealing heads (DK1-DK4) of plastically deformable material, preferably of a metal, are crimped onto the pipes of the optical-fibre
5 cables (MK1-MK6) in a sealing manner at peripheral crimping points (KRK), in that the closure pipe (MR1, MR2) likewise consists of deformable material, preferably of a metal, and is crimped on at its end faces onto the
10 sealing heads (DK1-DK4) at the peripheral crimping points (KRMR), in that the closure pipe (MR1, MR2) is dimensioned in length such that adequate excess lengths of optical waveguide (LU1, LU2) can be arranged in waveform extent and optical-fibre splices (LS) can be arranged.

41. Optical-fibre transmission system according to
15 Claim 27 or 40, characterized in that the optical-fibre splices (LS) are arranged in series one behind the other within the cable closure (KM).

42. Optical-fibre transmission system according to Claim 40, characterized in that the optical-fibre splices
20 (LS) are arranged next to one another within the cable closure (KM).

43. Optical-fibre transmission system according to one of Claims 40 to 42, characterized in that the bore (BDK) in the sealing head (DK1, DK2) is adapted in each
25 case to the diameter of the pipe of the optical-fibre cable (MK1-MK6) and in that a peripheral stop (AS) for the pipe of the corresponding optical-fibre cable (MK1-MK6) is arranged within the bore (BDK).

44. Optical-fibre transmission system according to
30 one of Claims 40 to 42, characterized in that

the sealing head (DK3, DK4) has a plurality of lead-in bores (EB), in that crimpable cable lead-in spigots (KES1-KES4) are inserted in a sealtight manner in the lead-in bores (EB), the seals between the pipes of the optical-fibre cables (MK1-MK6) and the cable lead-in spigots (KE1-KE4) taking place at the peripheral crimping points (KRK).

45. Optical-fibre transmission system according to one of Claims 40 to 44, characterized in that the sealing heads (DK1-DK4) and/or the closure pipe (MR1, MR2) consist of copper or similarly plastically deformable metal or copper-based wrought alloys.

46. Optical-fibre transmission system according to one of Claims 40 to 44, characterized in that the sealing heads (DK1 to DK4) and/or the closure pipe (MR1, MR2) consist of aluminium or cold-workable, non-hardenable aluminium alloys.

47. Optical-fibre transmission system according to one of Claims 40 to 44, characterized in that the sealing heads (DK1 to DK4) and/or the closure pipe (MR1, MR2) consist of plastically deformable, non-hardened, stainless steel.

48. Production of a sealtight splice connection with the aid of a cable closure for an optical-fibre transmission system according to one of Claims 40 to 47, characterized in that the closure pipe (MR1, MR2) is pushed over one end of the pipe of the one optical-fibre cable (MK1), in that this end of the optical-fibre cable (MK1) is fixed in a fixing (FMK1) and in that the one sealing head (DK1) is pushed onto and crimped onto this end of the optical-fibre cable (MK1),

in that at a distance, which corresponds to the closure pipe (MR1), the second sealing head (DK2) is crimped onto the likewise fixed end of the pipe of the second optical-fibre cable (MK2), in that subsequently the required
5 splicing work is carried out, in particular with the aid of a splicer (SPG), excess lengths of optical waveguide (LU1, LU2) being provided on both sides of the splices (SS), in that then the closure pipe (MR1), extending over and beyond the excess lengths of optical waveguide (LU1,
10 LU2) and the splices (SS), is crimped on in a sealtight manner on the two positioned sealing heads (DK1, DK2).

49. Optical-fibre transmission system according to one of Claims 40 to 47, characterized in that the electrically conductive pipes of the microcables (MK1)
15 are through-connected electrically conductively to one another by the closure pipe (MR1) and the crimped-on sealing heads (DK1).

50. Optical-fibre transmission system according to one of Claims 2 or 26, characterized in that the sealing
20 heads have threads at their ends, in that deformable cutting rings are inserted at the sealing points between the sealing head outer facings and the closure pipe and between the sealing head bores and the pipe ends of the microcables, in that union nuts over the cutting rings
25 are screwed onto the threads of the sealing heads.

51. Method of connecting a microcable comprising a pipe with led-in optical waveguides, which is introduced into a laying channel in firm laying ground, to an existing optical-fibre transmission system of a conven-
30 tional type with cable closures from the optical-fibre transmission system according to one of the preceding claims, characterized in that

the microcable (105) is led into an adapter closure (110), for receiving microcables, through a cable lead-in (107) of a manhole (103) of the existing optical-fibre transmission system (104) which has been made in the same laying ground, in that optical waveguides of a flexible cross-connecting cable (111) are spliced onto the optical waveguides of the microcable (105) within the adapter closure (110) and in that the cross-connecting cable (111) is led into a conventional splicing closure (113) for optical waveguides for connection to the optical cables of the existing optical-fibre transmission system (104), the joining together being performed within the splicing closure (113).

52. Method according to Claim 51, characterized in that the microcable (105) led into the manhole (103) is mechanically protected by a protective pipe (109) up to the adapter closure (110).

53. Method according to one of Claims 51 or 52, characterized in that a core hole (108) is made into the laying ground (102) on the outer side of the wall of the manhole (103) in the intended leading-in region, in that the lead-in of the microcable (105) is led via the core hole (108) and beyond into the manhole (103) in a seal-tight manner by seals (107).

54. Method according to one of Claims 51 to 53, characterized in that microcables at different laying heights are led into a manhole (103).

55. Method of connecting an optical-fibre transmission system comprising a cable closure and at least one microcable comprising a pipe with led-in optical waveguides, which has been introduced into a main channel in solid laying ground,

5 according to one of the preceding claims, to an existing
optical-fibre transmission system of a conventional type,
characterized in that the microcable (117) is led at the
end of the solid laying ground (102) into an adapter
closure (120) at the height of the laying channel and is
spliced onto a buried cable (124), in that the buried
cable (124) is laid in the earth (123) at the height of
the leading-in level of the manhole (103) made in the
earth (123), is led into the manhole (103) and is spliced
10 there within a splicing closure (113) onto the existing
optical-fibre network.

56. Optical-fibre transmission system according to
one of Claims 16, 17 or 37, characterized in that a
protective device for elongation loops of optical-fibre
15 cables, in particular of microcables, for terminating a
core hole in solid laying ground is arranged, in that the
protective device comprises a protective cover (SD) and
a driving-in peg (ES), provided centrally at one end, for
fixing in a central hole at the bottom of the core hole
20 (KB), in that the diameter of the protective cover (SD)
corresponds to the diameter of the core hole (KB) and in
that filling material is arranged above the protective
cover (SD) for sealtight termination and for filling the
remaining core hole (KB).

25 57. Optical-fibre transmission system according to
Claim 56, characterized in that laying channels (VN1,
VN2) run into and out of the core hole (KB) tangentially.

58. Optical-fibre transmission system according to
one of Claims 56 or 57, characterized in that the protec-
30 tive cover (SD) has on its upwardly facing side a pulling
eyelet (ZO).

59. Optical-fibre transmission system according to one of Claims 56 to 58, characterized in that the driving-in peg (ES) has in the free space of the core hole (KB), as a diameter limitation (EBS) for the elongation loop (DS), a diameter which corresponds to the minimum permissible bending radius of the led-in cable (MK).

60. Optical-fibre transmission system according to one of Claims 56 to 59, characterized in that the filling material (FM) consists of bitumen.

61. Optical-fibre transmission system according to Claim 60, characterized in that crushed solid materials, for example chippings, are added to the filling material (FM).

62. Optical-fibre transmission system according to one of Claims 56 to 61, characterized in that the free space of the core hole (KB) underneath the protective cover (SD) is filled with a filler, which does not hinder the free movement of the microcable (MK).

63. Optical-fibre transmission system according to one of Claims 1 to 24, characterized in that the cable closure (KMO) comprises an outer body (AK) which can withstand high mechanical loads and a cable-closure sealing body (KDK) fitted in the outer body (AK), in that the outer body (AK) has a removable outer cover (AD), which lies at the same height as the surface (SO) of the laying ground (VG), in that the cable-closure sealing body (KDK) lying thereunder is closed off by an upwardly removable sealing cover (DD), in that cable connection units (KA1, KA2, KA3) in pipe form

are led in from below through the outer body (AK) into the cable-closure sealing body (KDK) and in that the ends of the cables (K, MK) are led into these cable connection units (KA1, KA2, KA3) and sealed off.

5 64. Optical-fibre transmission system according to Claim 63, characterized in that the ends of the cables in the form of microcables (MK), respectively comprising a pipe and optical waveguides guided therein, are connected in a sealtight manner to the cable connection units (KA)
10 by crimped connections (KV).

65. Optical-fibre transmission system according to one of Claim 63, characterized in that a shrink tube piece (SS) is arranged at the end of a cable connection unit (KA3) for the sealtight leading in of a cable (K).

15 66. Optical-fibre transmission system according to one of Claims 63 to 65, characterized in that the leading-in points of the cable connection units, (KA1, KA2, KA3) are bent off in a horizontal direction at the laying height of the cables (K, MK) introduced in the
20 laying ground (VG).

67. Optical-fibre transmission system according to one of Claims 63 to 65, characterized in that the cable closure (KMO) has additional cable connection units on the side wall, which are fitted on at the height of
25 laying channels for microcables.

68. Optical-fibre transmission system according to one of Claims 63 to 65, characterized in that

GR 96 P 1041 P
PCT/DE 96/02331
WO 97/26574

- 58c -

the intermediate space between the cable-closure sealing body (KDK) and the outer body (AK) is filled with a filler (FS), preferably an expandable plastics foam.

GR 96 P 1041 P

Abstract

Cable closure for optical waveguides with splice organizers and excess-length depositories

The invention relates to a cable closure for optical-fibre cables, preferably optical-fibre minicables or optical-fibre microcables, with cable lead-in units, which are arranged perpendicularly with respect to the axis of the closure body, it being possible for them to be fitted vertically into a core hole made into the earth or into road surfacings. On account of laid-in excess lengths of optical waveguide, splice organizers in the interior of the closure body can be taken out upwards for service work. Preferably, the excess lengths of optical waveguide are carried in a protective tube, which is deposited in a plurality of loops in the interior of the closure.

Figure 6

66744-100000

1/18

FIG 1

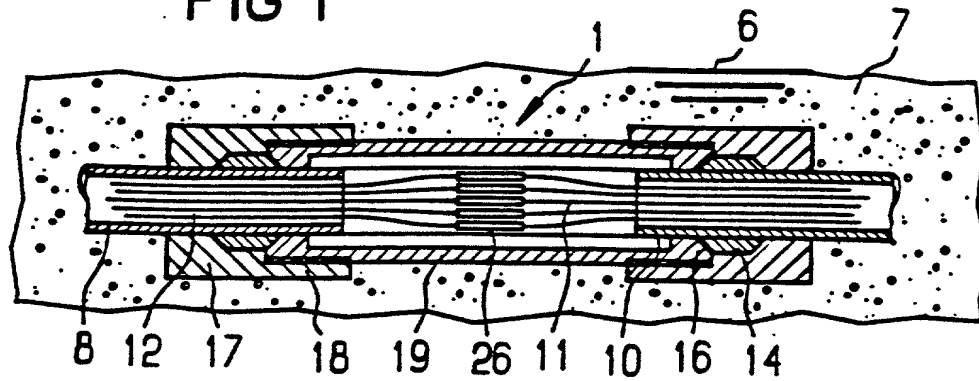


FIG 2

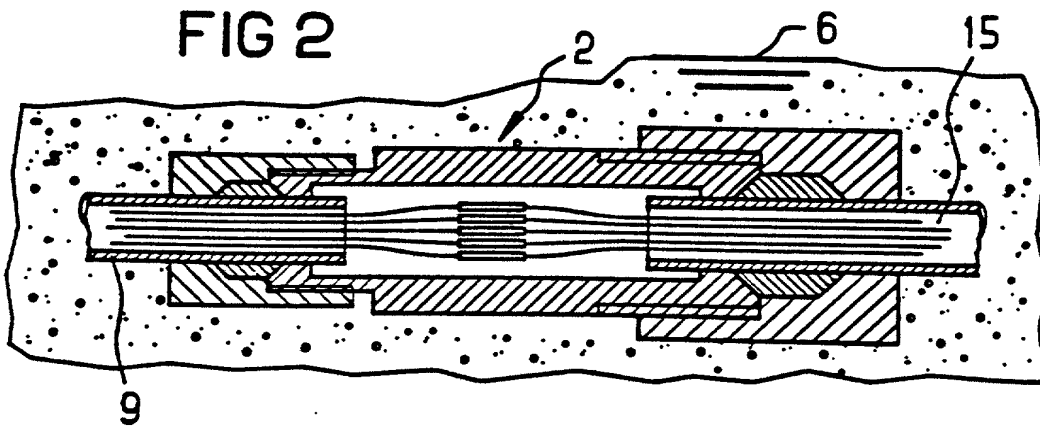
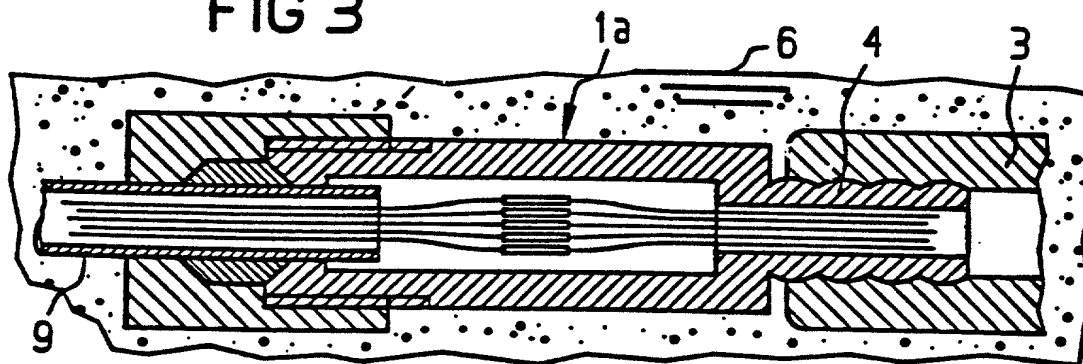


FIG 3



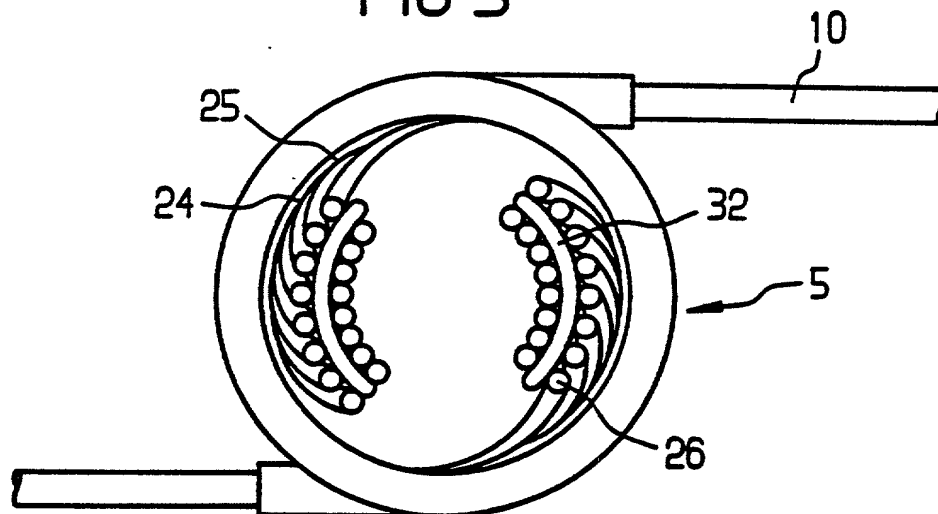
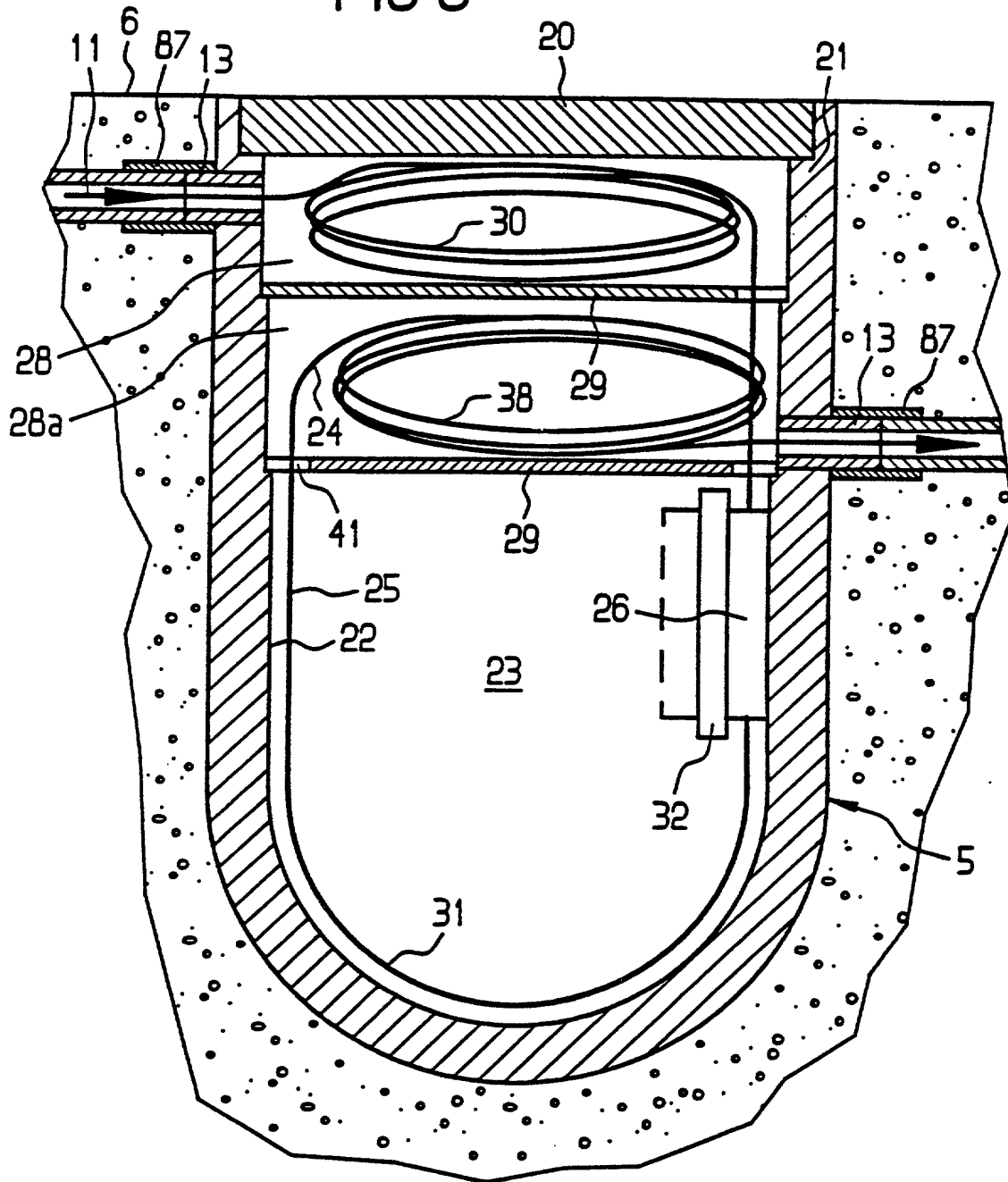
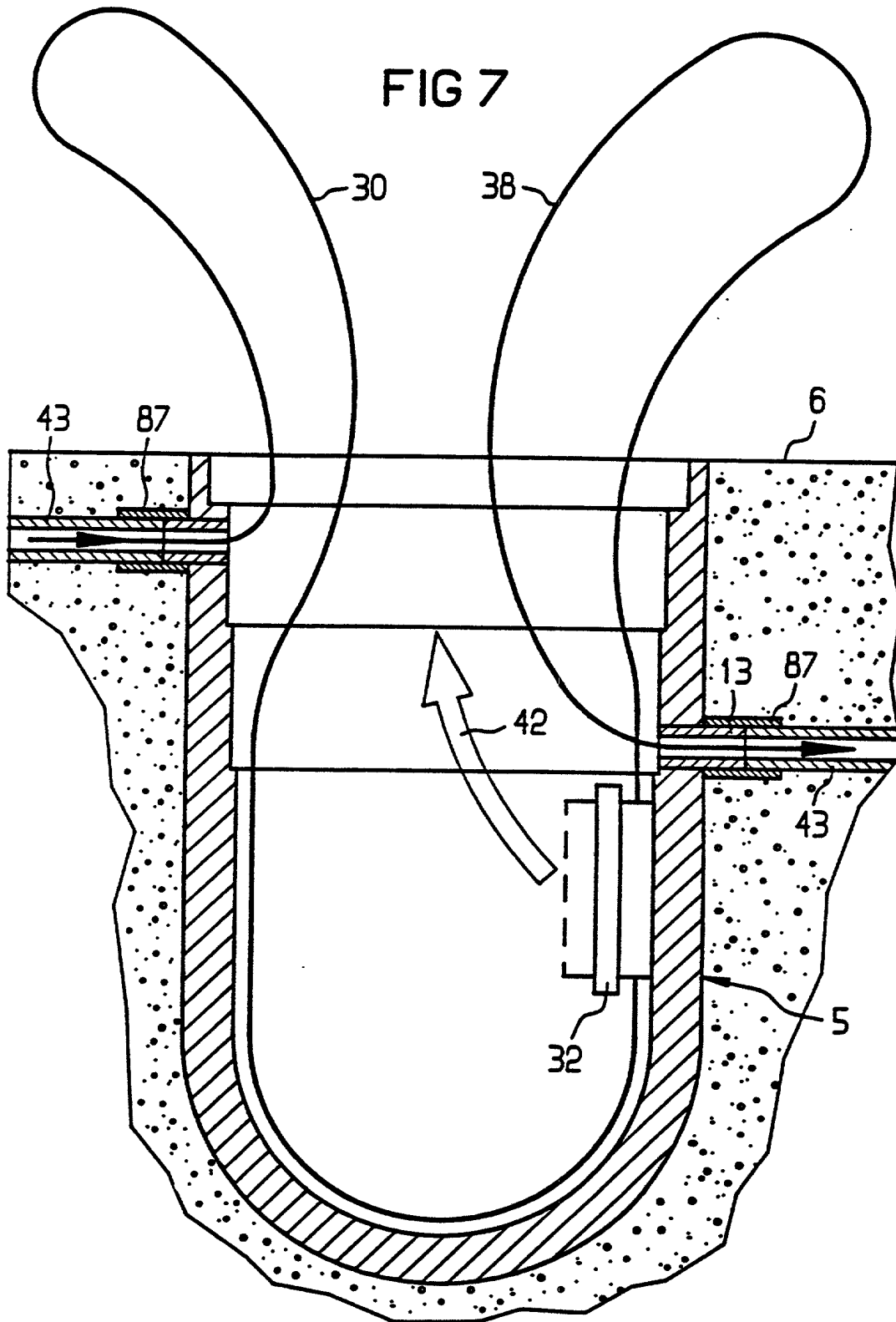


FIG 6



4/18

FIG 7



5/18

FIG 8

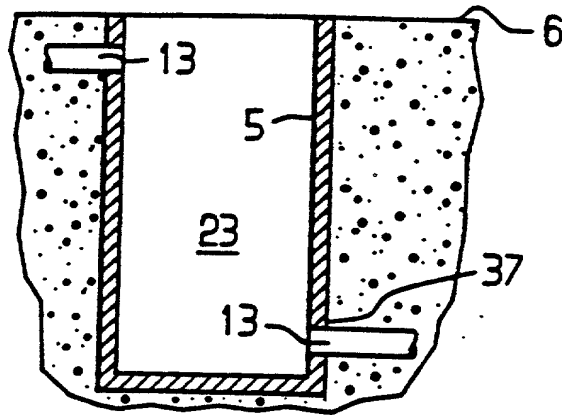


FIG 9

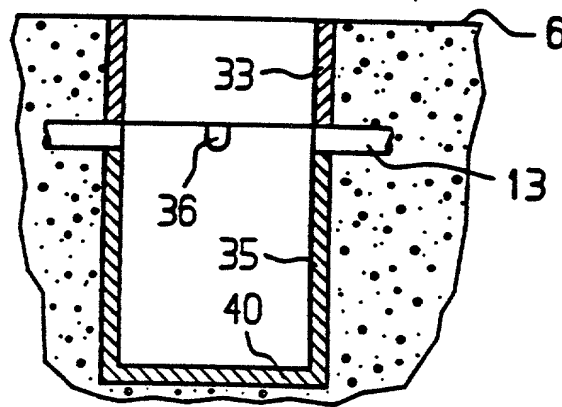
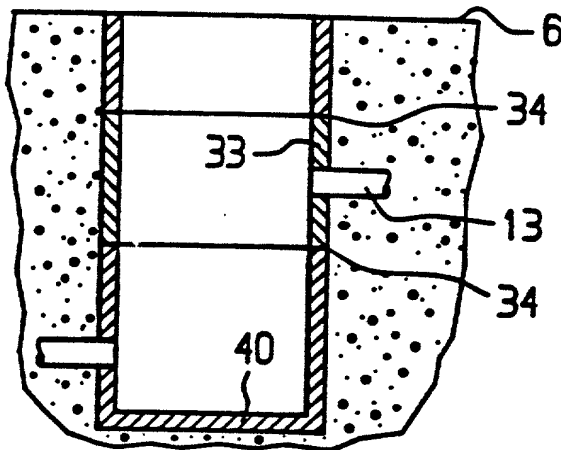
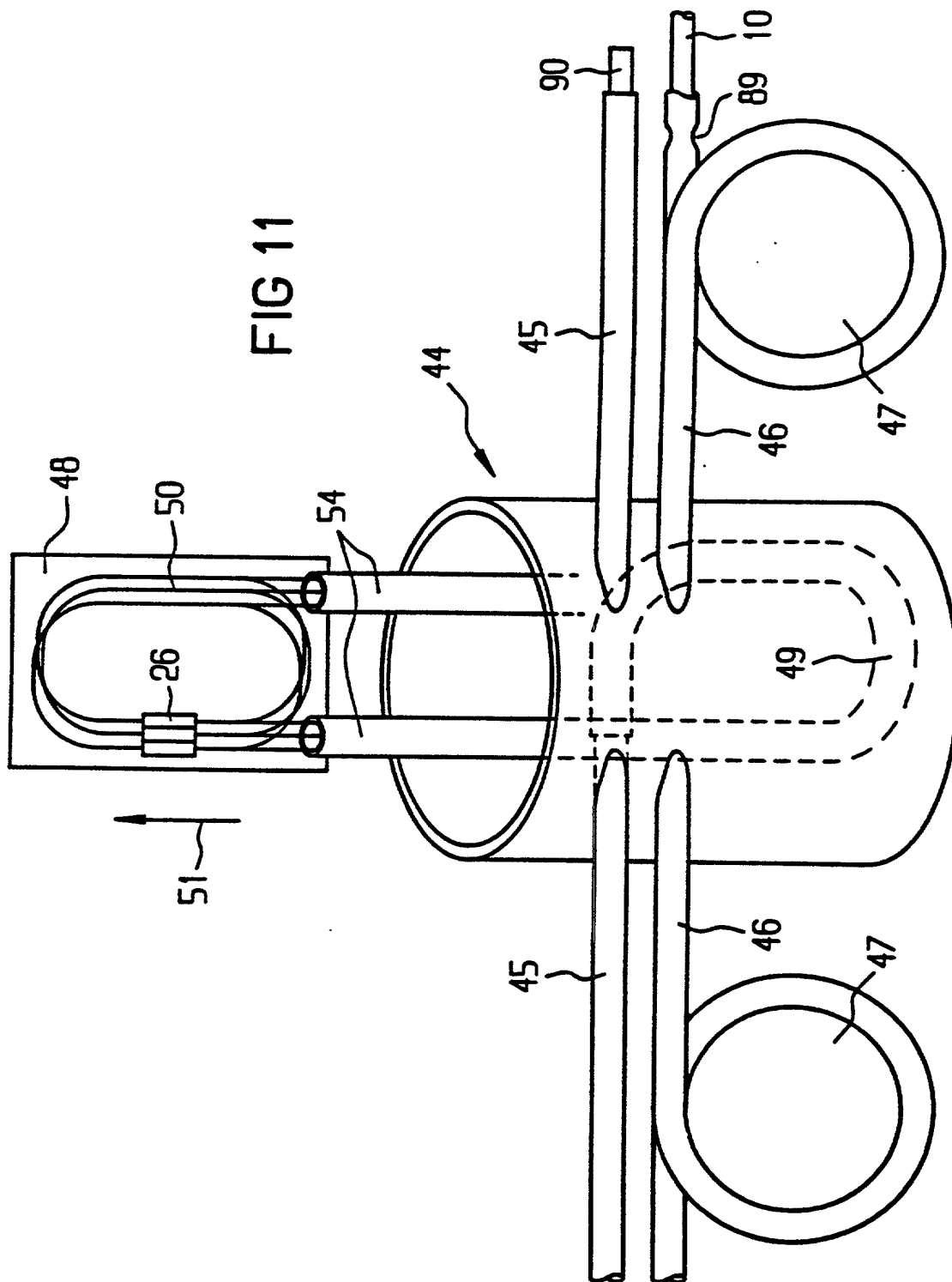


FIG 10



6/18

FIG 11



7/18

FIG 12

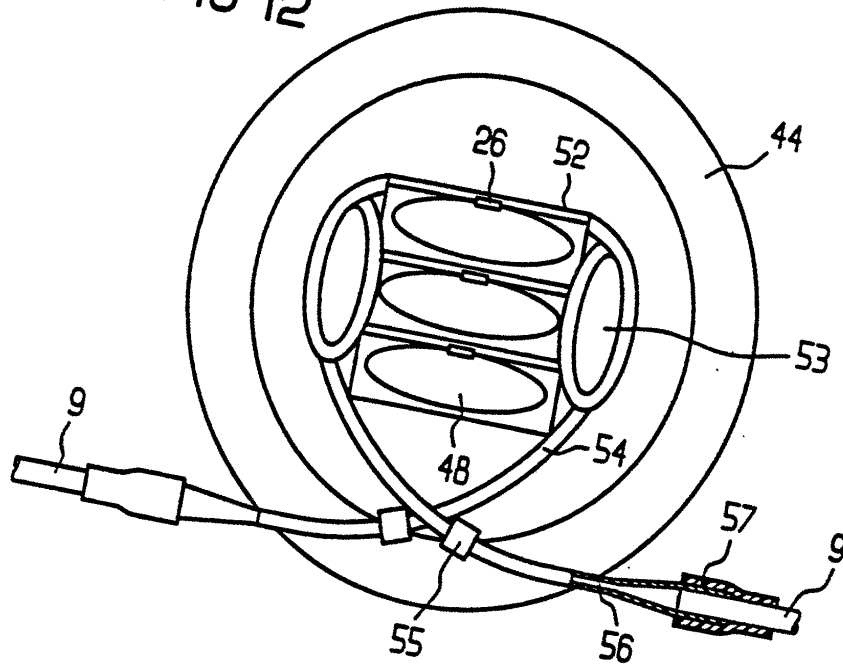
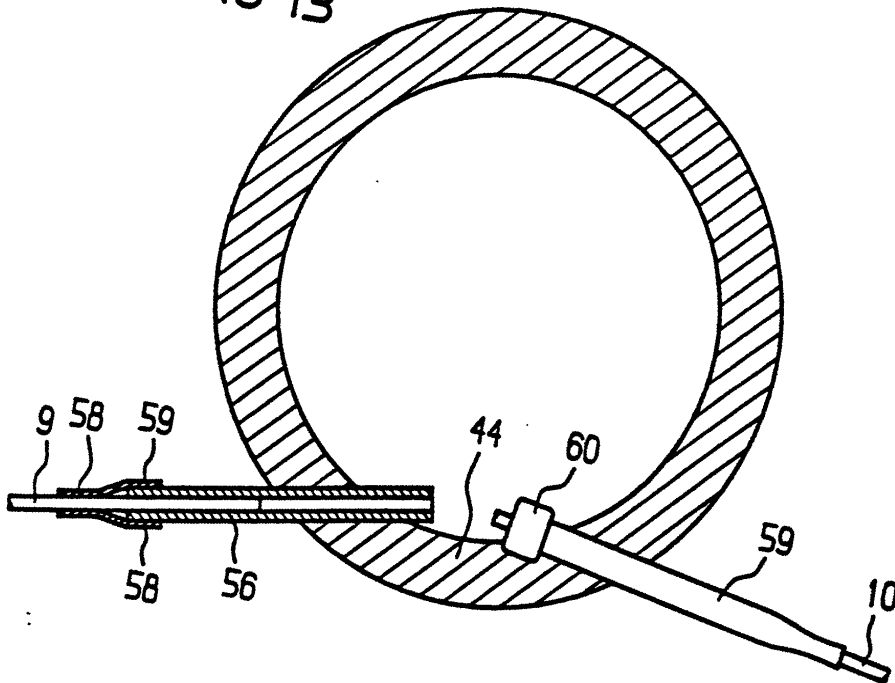
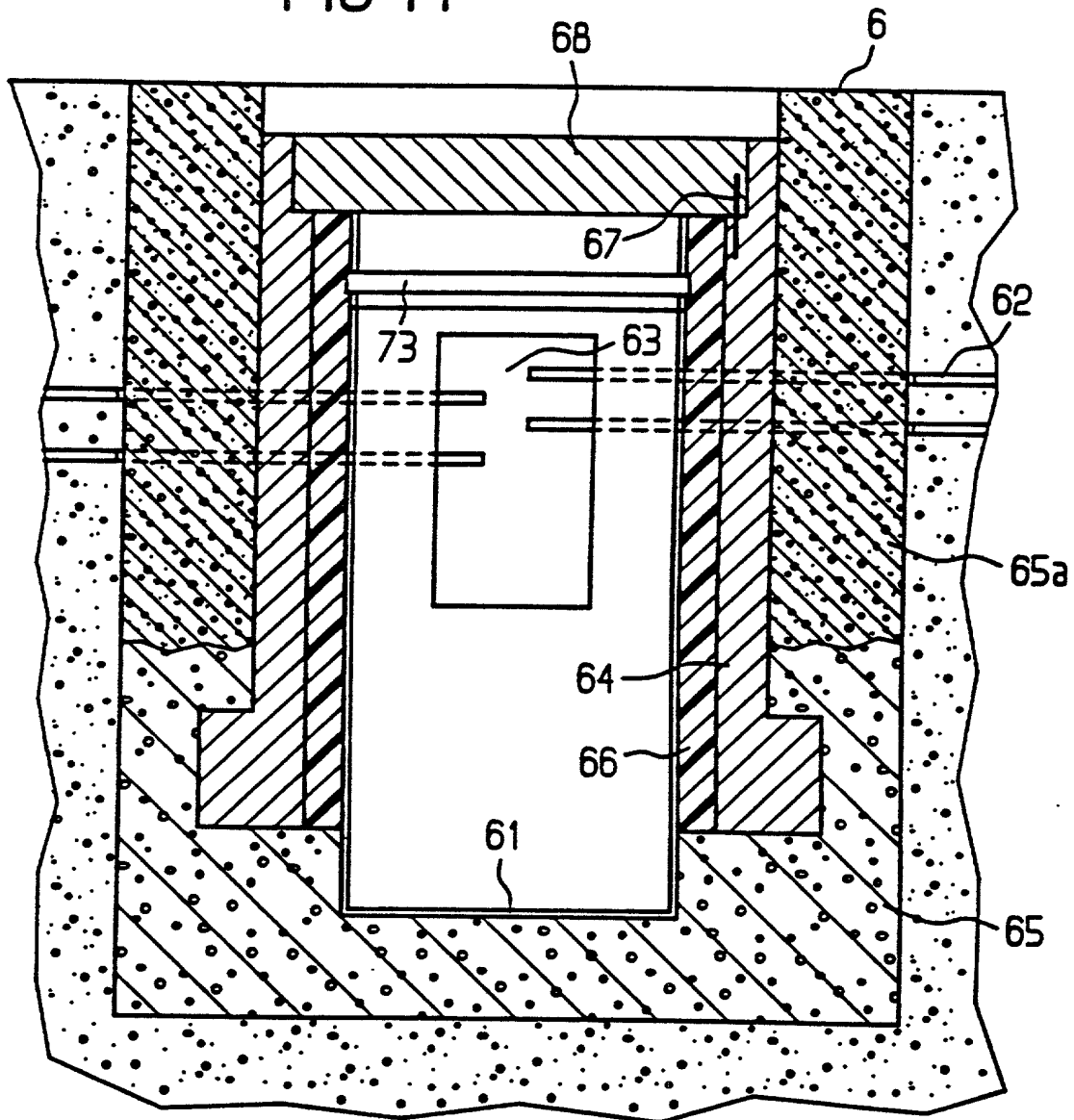
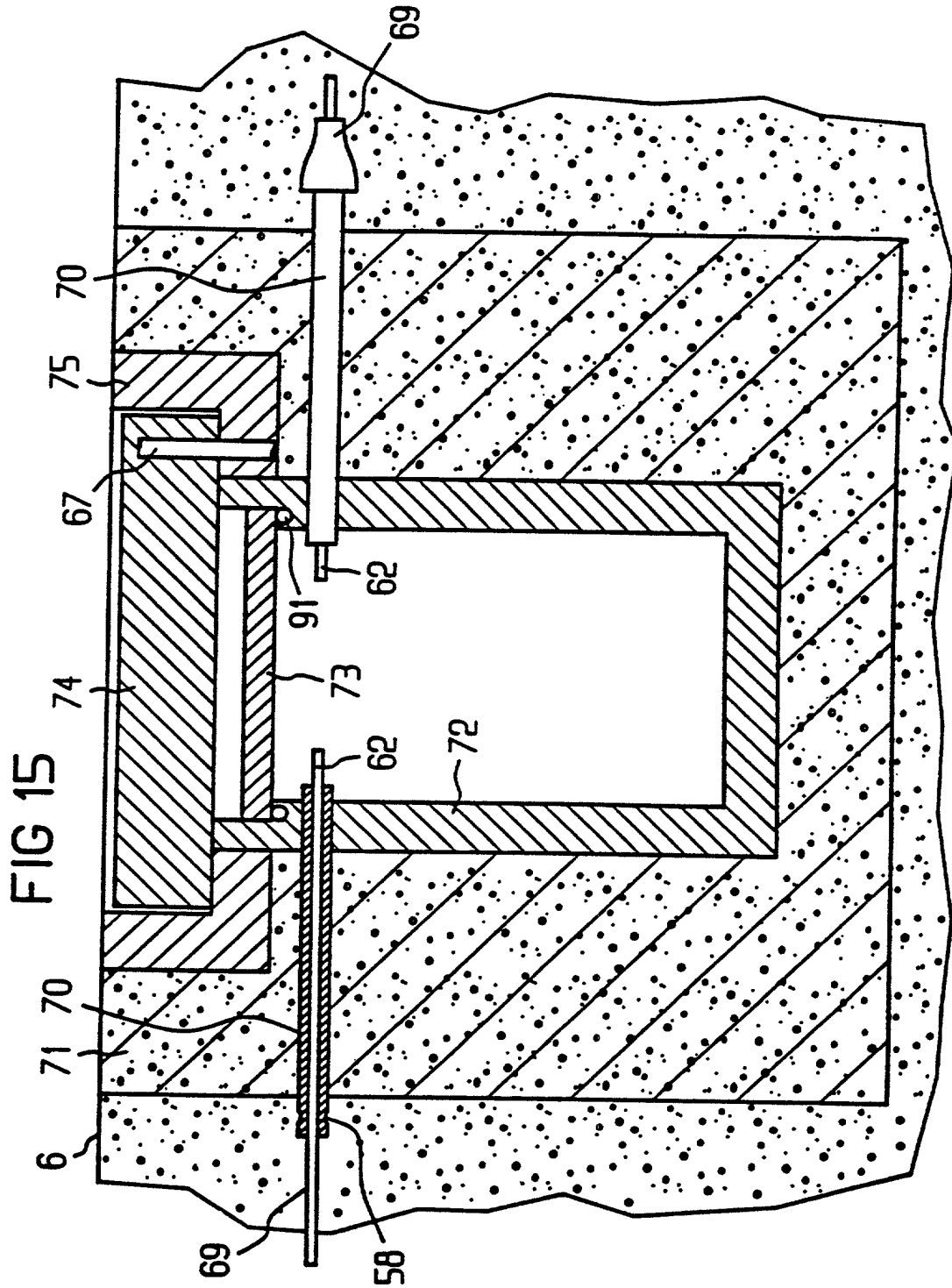


FIG 13





9/18



10/18

FIG 16

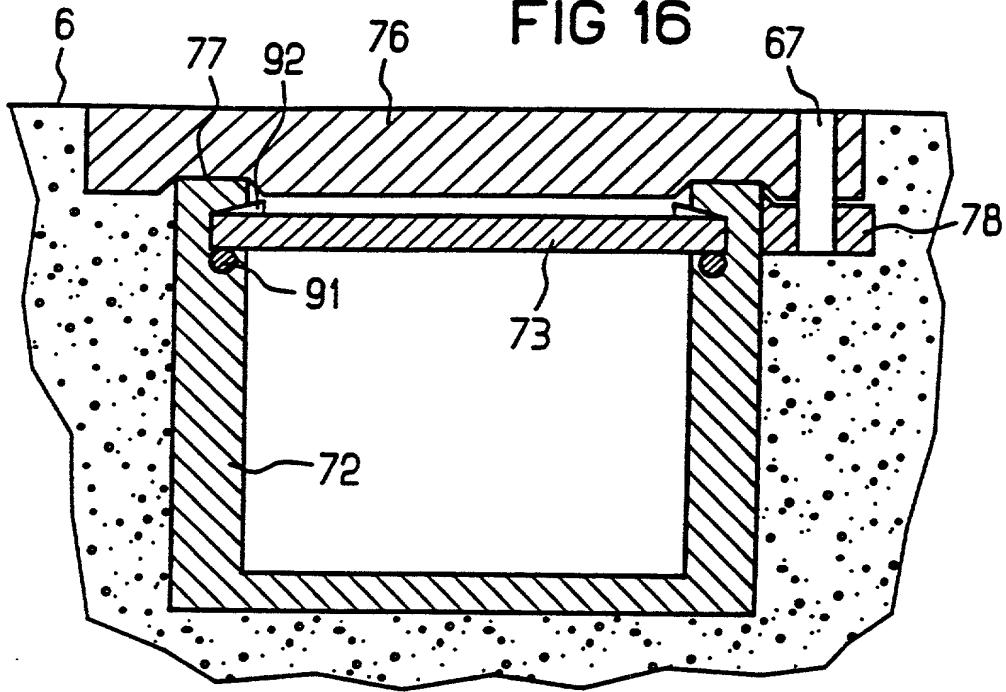
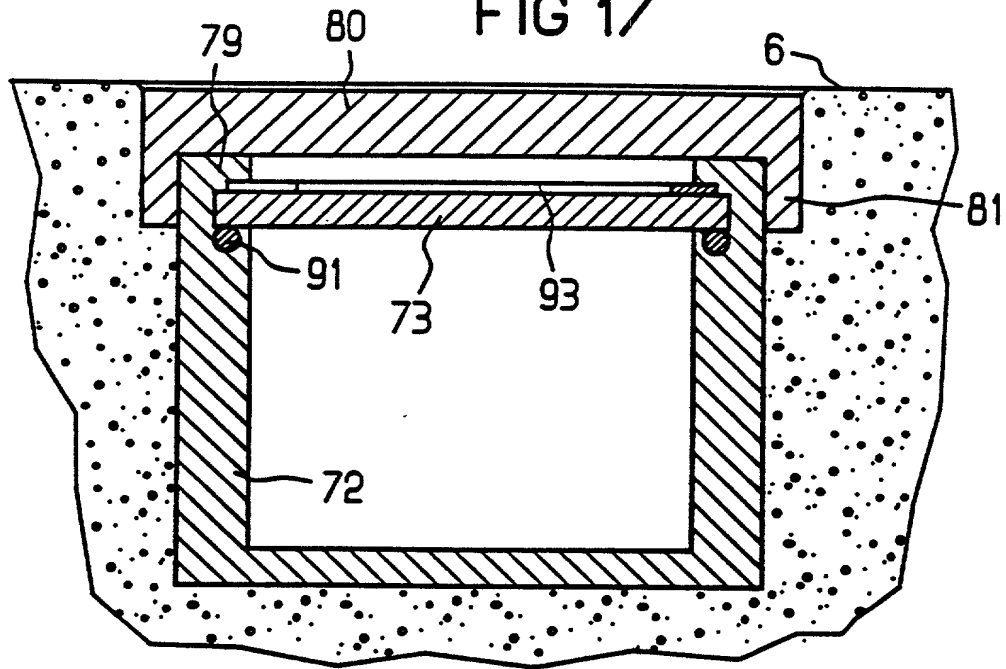


FIG 17



11/18

FIG 18

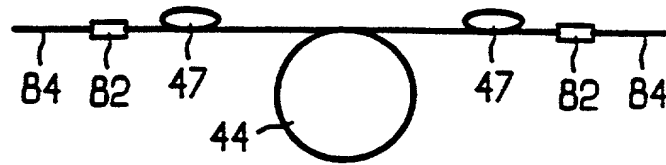


FIG 19

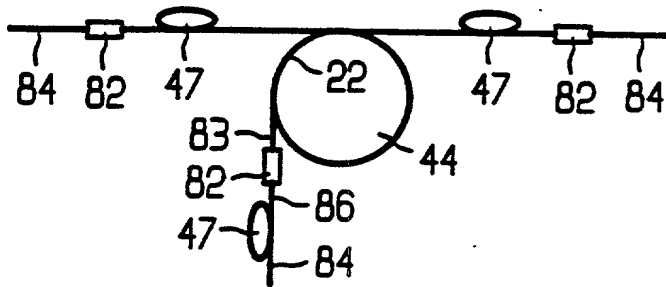


FIG 20

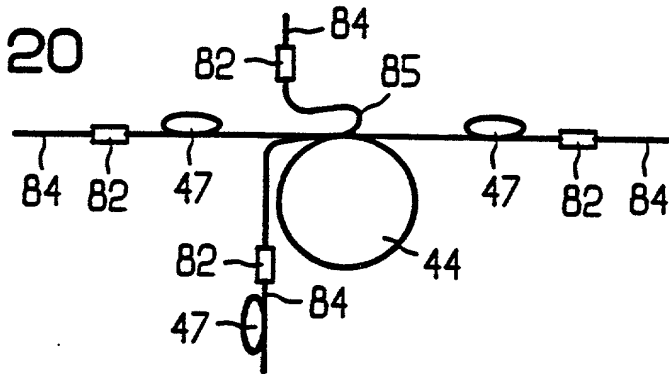


FIG 21

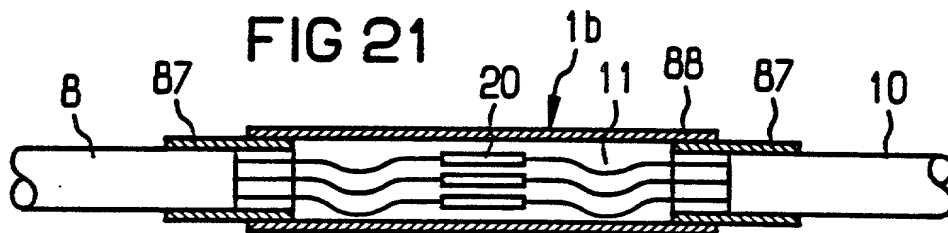
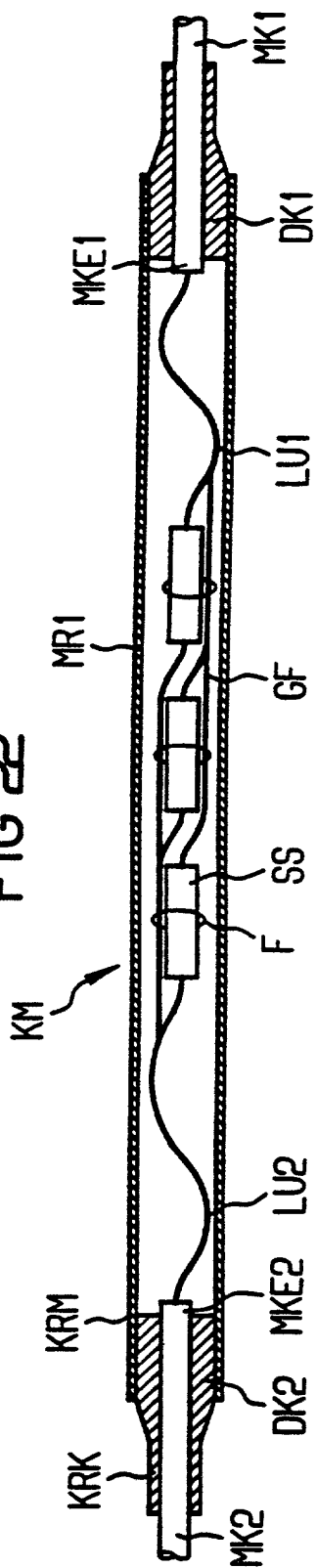


FIG 22



13/18

FIG 23

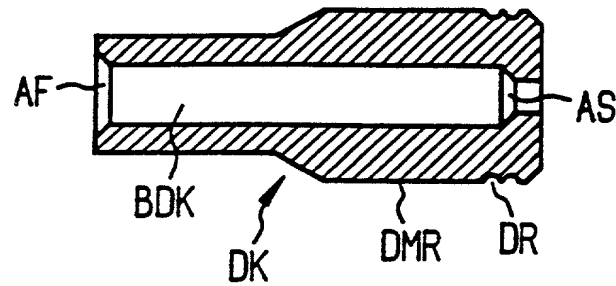


FIG 24

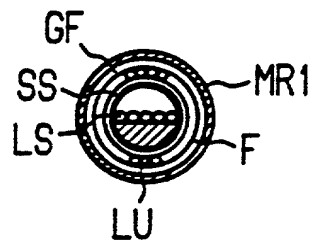


FIG 25

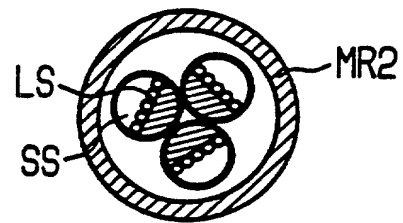
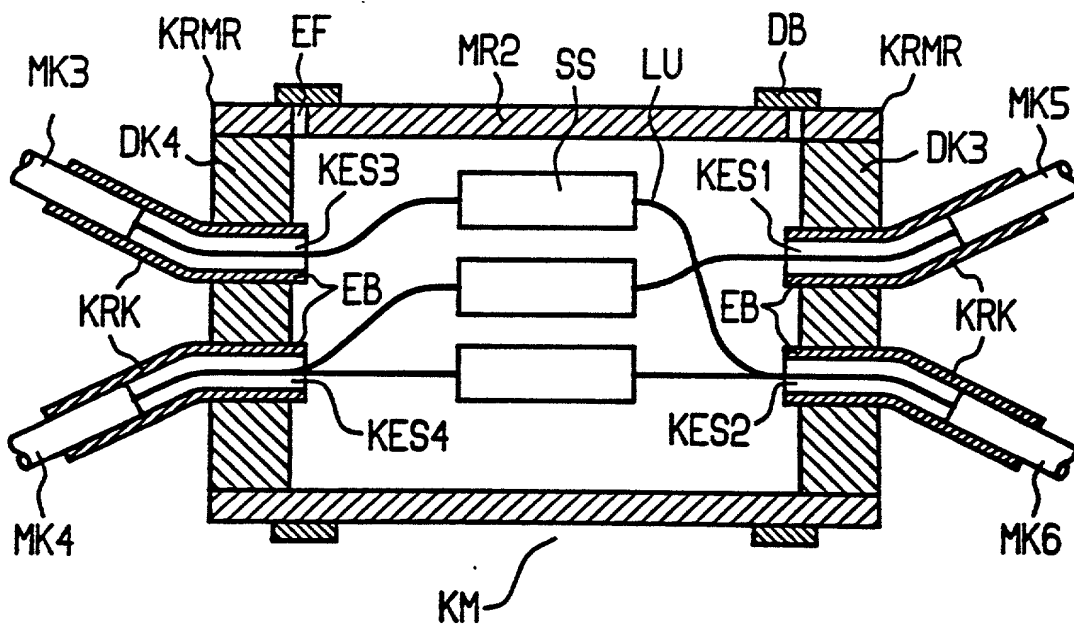
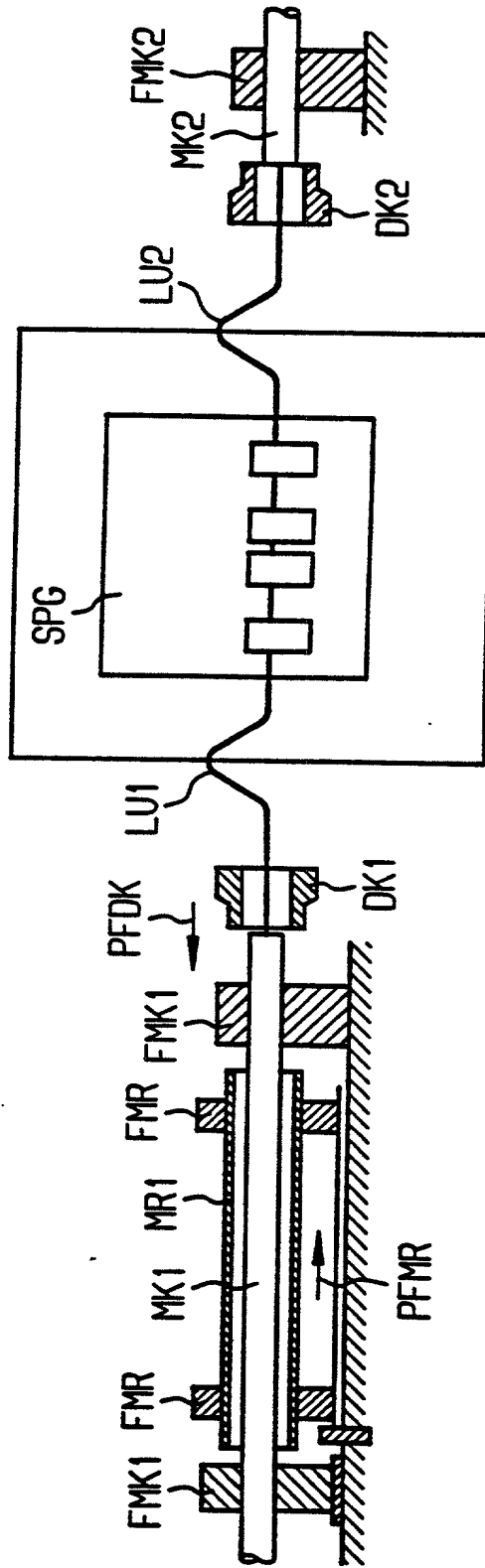


FIG 26

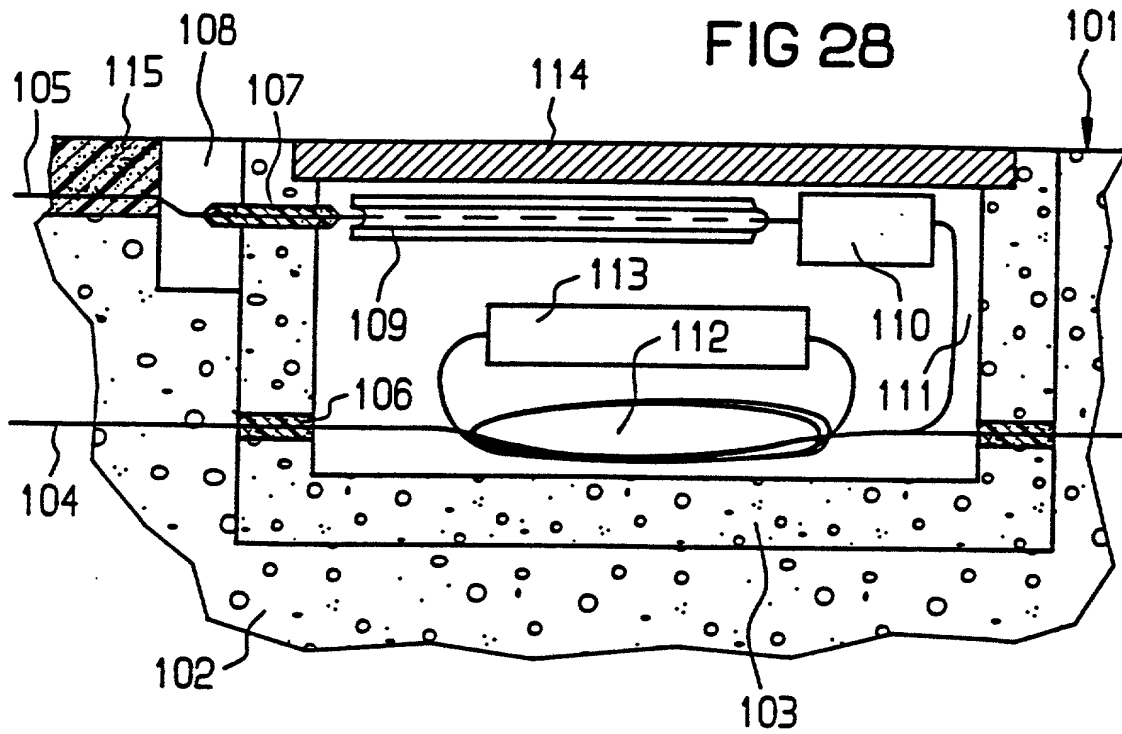


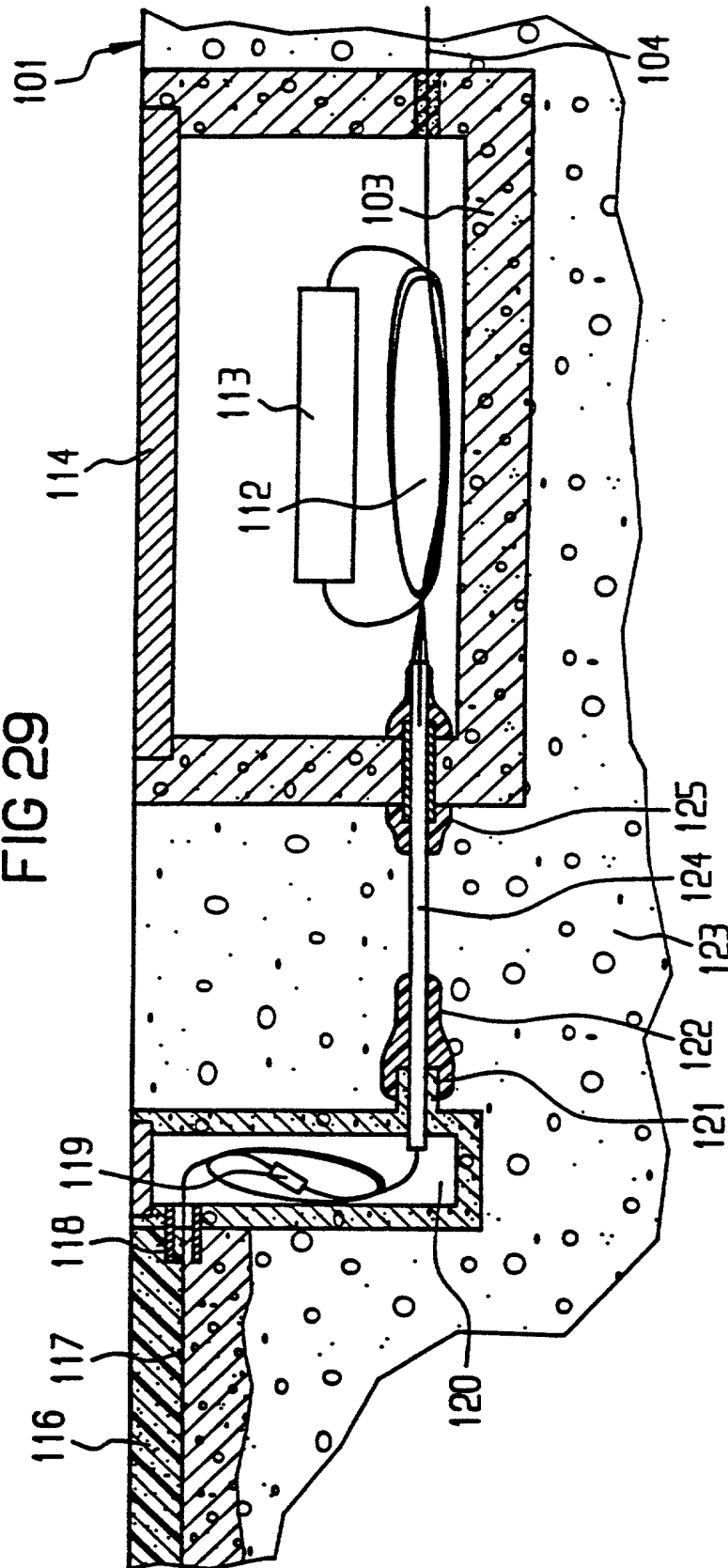
14/18

FIG 27



15/18





17/18

FIG 30

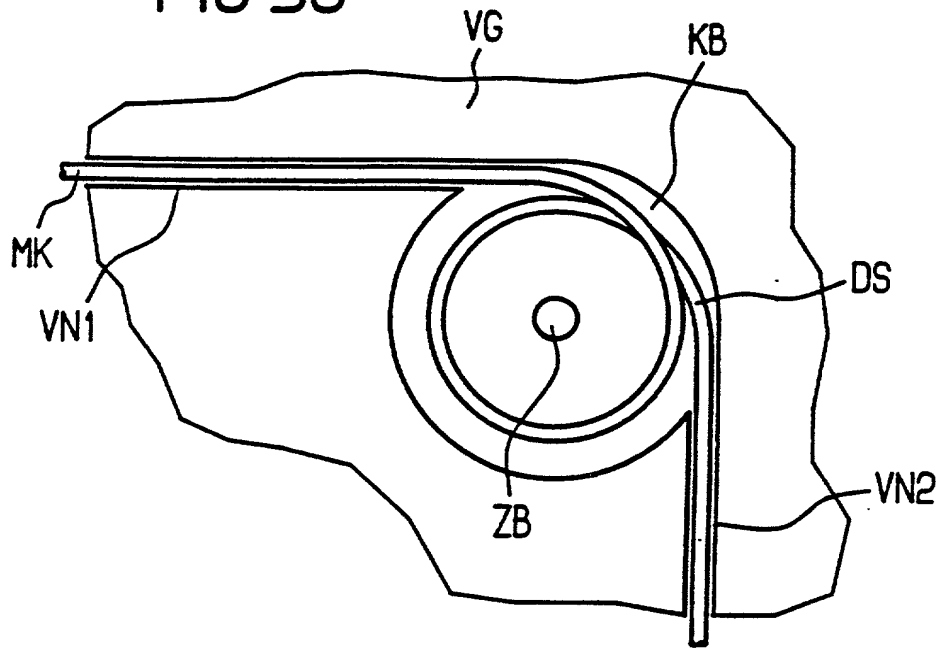
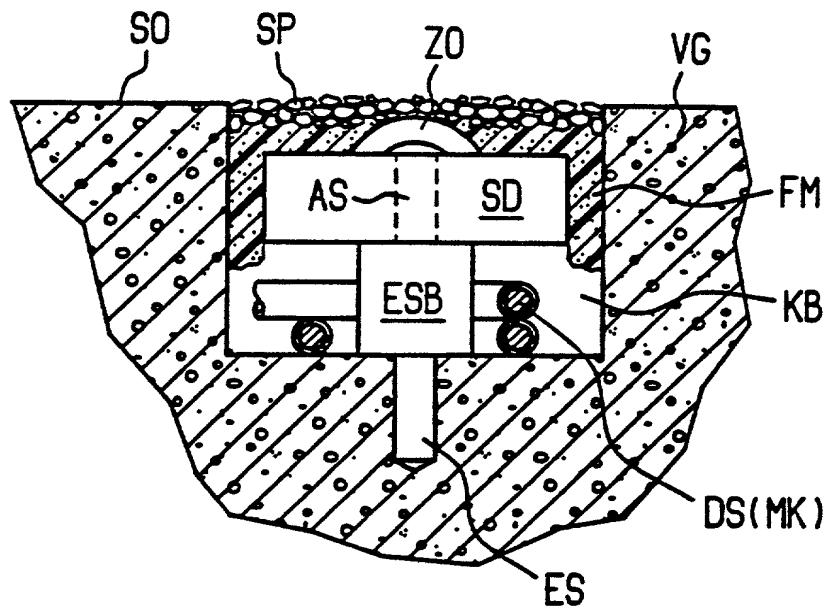
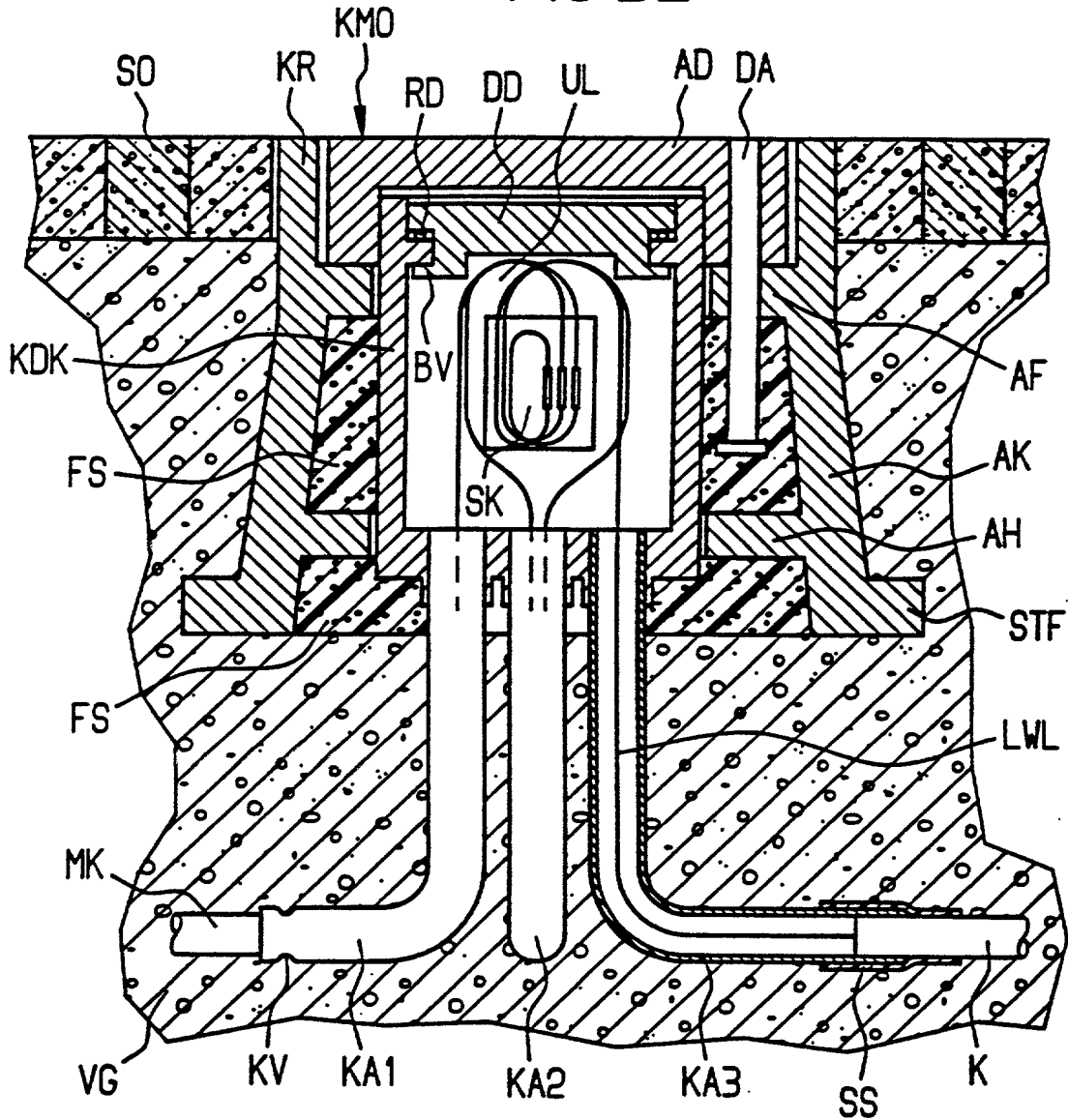


FIG 31



18/18

FIG 32



Declaration and Power of Attorney For Patent Application

Erklärung Für Patentanmeldungen Mit Vollmacht

German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

Kabelmuffe für Lichtwellenleiter mit Spleißkassetten und Überlängenablagen

deren Beschreibung

(zutreffendes ankreuzen)

☒ hier beigefügt ist.

☐ am _____ als

PCT internationale Anmeldung

PCT Anwendungsnummer _____
eingereicht wurde und am _____
abgeändert wurde (falls tatsächlich abgeändert).

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

the specification of which

(check one)

☐ is attached hereto.

☐ was filed on _____ as

PCT international application

PCT Application No. _____
and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

German Language Declaration

Prior foreign applications
Priorität beansprucht

Priority Claimed

<u>196 01 576.6</u>	<u>Germany</u>	<u>17. Januar 1996</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein
<u>196 16 597.0</u>	<u>Germany</u>	<u>25. April 1996</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein
<u>196 23 482.4</u>	<u>Germany</u>	<u>12. Juni 1996</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein
<u>196 41 443.1</u>	<u>Germany</u>	<u>08. Oktober 1996</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein
<u>196 41 442.3</u>	<u>Germany</u>	<u>08. Oktober 1996</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.)
(Anmeldeseriennummer)

(Filing Date)
(Anmeldedatum)

(Status)
(patentiert, anhängig,
aufgegeben)

(Status)
(patented, pending,
abandoned)

(Application Serial No.)
(Anmeldeseriennummer)

(Filing Date)
(Anmeldedatum)

(Status)
(patentiert, anhängig,
aufgeben)

(Status)
(patented, pending,
abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patenten gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

- 1 -

IN THE UNITED STATES ELECTED OFFICE OF
THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY - CHAPTER II

PRELIMINARY AMENDMENT

5 APPLICANTS: Lothar Finzel, Günter Schröder and Heinz Diermeier
ATTORNEY
DOCKET NO.: P-98,1197
SERIAL NO.: EXAMINER:
FILING DATE: ART UNIT:
10 INTERNATIONAL APPLICATION NO.: PCT/DE96/02331
INTERNATIONAL FILING DATE: 5 December 1996
INVENTION: "CABLE JOINT FOR OPTICAL FIBRES WITH SPLICING
CASSETTES AND OVERLENGTH LOOPS"

BOX PCT

15 Assistant Commissioner for Patents
Washington, D.C. 20231

S I R:

Please amend the above-identified International Application before entry
into the National Stage before the U.S. Patent and Trademark Office under 35 USC
20 371 as follows:

IN THE SPECIFICATION:

Substitute page 1, line 1, delete "Description" and insert the following
heading:

--TITLE--;

25 line 4, before "The" insert the following heading:

--BACKGROUND OF THE INVENTION--;

line 19, change "comprising" to read --and the accessories have--;

line 21, change "Used there is" to read --The accessory has--;

line 22, after "seals," insert --and--;

5 lines 23 and 26, change "being" (both occurrences) to read --are--;

and

line 25, after "ducts," insert --and--.

Substitute page 2, line 10, change "the lead-ins being" to read --and the
lead-ins are--;

10 line 29, change "lying" to read --to lie--; and

line 32, after "welding." insert the following heading:

--SUMMARY OF THE INVENTION--.

Substitute page 2a, line 3, before "these" insert --and--;

line 4, change "comprising" to read --comprise--;

15 line 17, after "cables," insert --and--;

line 22, change "way, corresponding to the" to read --way of
forming the sealing connections by a press connection with a union nut, a
plastic crimped connector or an elastic annular seal.--; and

line 23, delete the entire line.

20 Page 5, line 6, change "site," to read --site with--.

Page 8, replace lines 1-4 with the following paragraph and heading:

--Other advantages and features of the invention will be readily apparent from the following description of the preferred embodiments, the drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS--;

5

line 5, replace this line with the following:

--Figure 1 is a longitudinal cross-sectional view of an--;

line 8, change "shows" to read --is a longitudinal cross-sectional view of--;

line 10, change "shows" to read --is a--;

10

same line, change "section through" to read --cross-sectional view of--;

line 12, change "shows" to read --is a plan view of--;

line 13, change "shows" to read --is a plan view of--;

lines 16 and 17, change these lines to read as follows:

15

--Figure 6 is a longitudinal cross-sectional view of a cylindrical closure,--;

line 18, change "shows" to read --is a longitudinal cross-sectional view of--;

line 20, change "shows" to read --is a cross-sectional view of--;

line 22, change "shows" to read --is a cross-sectional view of--;

20

line 25, change "shows" to read --is a cross-sectional view of--;

line 28, change "shows" to read --is a top plan view of--;

lines 29 and 30, change "waveguides in a view from above," to read

--waveguides,--;

line 31, change "shows" to read --is a cross-sectional view of--;

25

lines 32 and 33, delete "in a view from above,"; and

lines 34, 36 and 38, change "shows" (each occurrence) to read --is a cross-sectional view of--.

Page 9, line 1, change "shows" to read --is a cross-sectional view of--;

line 4, change "shows in a diagram" to read --is a diagram of--;

lines 5 and 7, change "in the case of" (each occurrence) to read --for--;

line 8, change "shows in a diagram" to read --is a diagram of--;

lines 8 and 9, change "in a case of" to read --for--;

lines 10 and 13, change "shows" (each occurrence) to read --is a longitudinal cross-sectional view of--;

line 14, delete "in a longitudinal section";

line 15, change the line to read --Figure 23 is a cross-sectional view of a sealing head,--;

lines 16 and 17, change "shows" (both occurrences) to read --is a transverse cross-sectional view of--;

lines 19 and 20, change "shows" (both occurrences) to read --is a cross-sectional view of--;

line 22, change "shows the" to read --is a cross-sectional view of an arrangement for--;

line 24, change the line to read --Figure 29 is a cross-sectional view of an arrangement in a--;

line 25, delete "is"; and

line 26, change "shows" to read --is a plan view of--.

Page 10, lines 1 and 2, change "shows" (both occurrences) to read --is a cross-sectional view of--;

line 4, after "above." insert the following heading:

--DESCRIPTION OF THE PREFERRED EMBODIMENTS--;

line 17, after "rings," insert --and--;

line 18, change "17-18 being" to read --is--;

5 line 30, after "used," insert --and--; and

line 31, change "being" to read --is--.

Page 11, line 33, after "function," insert --and--; and

line 34, change "being" to read --are--.

Page 12, line 1, before "splice" insert --or arcuate segment--;

10 line 13, delete "shown"; and

lines 21 and 22, after "deck" (each occurrence) insert --or space--.

Page 13, line 22, after "let" insert --or placed--.

Page 14, line 19, change the line to read --sections or rings and it is possible
by--.

15 Substitute page 15, line 7, change "it having" to read --and it has--.

Substitute page 15a, line 2, change "fitted 55 onto the inner side" to read
--connected by fittings 55 onto the inner ends--.

Page 16, lines 36 and 37, change the lines to read --protective housing 64
is embedded in concrete 65, which is in a lower region of the core hole which is
20 formed in the road surface 6,--.

Page 17, line 32, change “being” to read --is--.

Page 20, line 32, delete “This”; and
line 33, delete the entire line.

Page 27, line 9, after “past” insert --the splice 55--;
line 15, change “3” to read --22--;
line 17, change “closure, here too” to read --closure. Two--;
line 18, change “being used, onto which” to read --are used, and--;
line 20, after “KRM R” insert --onto the heads DK3 and DK4--; and
line 32, change “MK1-MK4” to read --MK3-MK6--.

Page 28, line 19, change “MF1” to read --MR1--.

Page 36, line 12, after “in” insert --a--;
line 35, after “shown,” insert --and--; and
line 36, change “then being” to read --is then--.

Page 37, line 5, change “BS” to read --DS--;
line 6, change “comprising” to read --which comprises--;
line 8, delete “as”;
line 9, after “ESB” insert --of--;
line 11, change “K” to read --MK--; and
line 26, change “ESD” to read --SD--.

Page 39, line 7, change “object set” to read --set of objects--.

Page 42, lines 12 and 13, change "KA" (both occurrences) to read --KA1, KA2 and KA3--;

line 17, change "KA" to read --KA3--; and

line 20, after "MK" insert --and unit KA1--.

5 Substitute page 44, line 1, change "New Patent Claims" to read --**WE CLAIM:--**;

lines 2 and 3, delete these lines.

10 Page 59, line 1, change "Abstract" to read --**ABSTRACT OF THE DISCLOSURE--**;

lines 2 and 3, delete these lines;

line 8, change "it being possible for them" to read --and it is possible for the closure--; and

line 17, delete "Figure 6".

IN THE CLAIMS:

15 New claims 1-68 on the substitute pages.

Please amend claims 1-3 to read as follows:

20 --1. (Amended) Optical-fibre transmission system comprising a cable closure for optical waveguides with splice organizers and excess-length depositories for excess lengths of optical waveguide and comprising at least one optical fibre cable, cable lead-in units in the form of cable lead-in spigots being arranged to extend into the cable closure perpendicularly with respect to [the] an axis of [the] a closure body of the cable closure, the excess lengths of optical waveguide and the

splice organizers being arranged within the closure body removably in the axial direction of the closure body, and at least one end face of the closure body being closed off in a sealing manner by an externally accessible cover, [characterized in that] the improvement comprising the cable lead-in units [are designed as] being
5 lead-in spigots [(13)] in the form of pipes [(45, 46)] tightly fitted on the closure body, [in that] the optical-fibre cables [(10)] in the form of optical waveguide minicables or optical waveguide microcables, respectively comprising a pipe [(8, 9, 15)] and optical waveguides [(12)], optical waveguide strips or optical waveguide bundles loosely introduced therein, [are] said cables being arranged in the cable lead-in units
10 [(13, 17-18, 45, 46, 56, 70)] which are designed in terms of pipe connecting technology for receiving and sealing off the pipes [(8, 9, 15)] of the optical-fibre cables [(10)], the sealing connection of the pipe connecting technology being a connection selected from a group consisting of welded connections, soldered [or] connections and an adhesively bonded connection between the pipe [(8, 9, 15)] of the
15 optical-fibre cable [(10)] and the cable lead-in unit [(13)].--

--2. (Amended) Optical fibre transmission system comprising a cable closure for optical waveguides with splice organizers and excess-length depositories for excess lengths of optical waveguide and comprising at least one optical-fibre cable, cable lead-in units in the form of cable lead-in spigots being arranged to
20 extend into the cable closure perpendicularly with respect to [the] an axis of [the] a closure body of the cable closure, the excess lengths of optical waveguide and the splice organizers being arranged within the closure body removably in the axial direction of the closure body, and at least one end face of the closure body being closed off in a sealing manner by an externally accessible cover, [characterized in
25 that] the improvement comprising the cable lead-in units [are designed as] being lead-in spigots [(13)] in the form of pipes [(45, 46)] tightly fitted on the closure body,

[in that] the optical-fibre cables [(10) in the form of] being optical waveguide minicables or optical waveguide microcables, respectively comprising a pipe [(8, 9, 15)] and optical waveguides [(12)], optical waveguide strips or optical waveguide bundles loosely introduced therein, [are] said cable being arranged in the cable lead-in units [(13, 17-18, 45, 46, 56, 70)] which are designed in terms of pipe connecting technology for receiving and sealing off the pipes [(8, 9, 15)] of the optical-fibre cables [(10)], the sealing connection of the pipe connecting technology being a press connection with sealing means and a pressing element with a union nut, between the pipe [(8, 9, 15)] of the optical-fibre cable [(10)] and the cable lead-in unit [(13)].--

--3. (Amended) Optical-fibre transmission system comprising a cable closure for optical waveguides with splice organizers and excess-length depositories for excess lengths of optical waveguide and comprising at least one optical-fibre cable, cable lead-in units in the form of cable lead-in spigots being arranged to extend into the cable closure perpendicularly with respect to [the] an axis of [the] a closure body of the cable closure, the excess lengths of optical waveguide and the splice organizers being arranged within the closure body removably in the axial direction of the closure body, and at least one end face of the closure body being closed off in a sealing manner by an externally accessible cover, [characterized in that] the improvement comprising the cable lead-in units [are] being designed as lead-in spigots [(13)] in the form of pipes [(45, 46)] tightly fitted on the closure body, [in that] the optical-fibre cables [(10) in the form of] being optical waveguide minicables or optical waveguide microcables, respectively comprising a pipe [(8, 9, 15)] and optical waveguides [(12)], optical waveguide strips or optical waveguide bundles loosely introduced therein, [are] said cables being arranged in the cable lead-in units [(13, 17-18, 45, 46, 56, 70)] designed in terms of pipe connecting technology for receiving and sealing off the pipes [(8, 9, 15)] of the optical-fibre cables [(10)],

the sealing connection of the pipe connecting technology being selected from a group consisting of a plastic crimped connection [(58, 89) or] and a permanently elastic, annular seal between the pipe [(8, 9, 15)] of the optical-fibre cable [(10)] and the cable lead-in unit [(13)].--

5 Claim 4, line 2, change “characterized in that” to read --wherein--; and
 same line, delete “(5, 44)”.

 Claim 5, line 2, change “characterized in that” to read --wherein--.

 Claim 6, line 2, change “one of claims 1 to 5, characterized in that” to read
--claim 1, wherein--;

10 line 3, delete “(13)”;

 line 4, delete “(5, 44)”.

 Claim 7, line 2, change the line to read --claim 1, wherein--;

 line 3, delete “(13)”;

 line 4, delete “(5, 44)”.

15 Claim 8, line 2, change the line to read --claim 1, wherein the--; and
 line 3, delete “(13)”.

 Claim 9, line 2, change the line to read --claim 1, wherein the cable--; and
 line 3, delete “(13)”.

20 Claim 10, line 2, change the line to read --claim 1, wherein the--; and
 line 3, delete “(13)”.

Claim 11, line 2, change the line to read --claim 1, wherein the cable--; and
line 3, delete "(13)".

Claim 12, line 2, change the line to read --claim 1, wherein the--;
line 3, delete "(24)"; and
line 4, delete "(5)".

Claim 13, line 2, change the line to read --claim 1, wherein--;
line 3, delete "(30, 38)"; and
line 5, delete "(5)".

Claim 14, line 2, change the line to read --claim 1, wherein the--; and
line 4, delete "(54)".

Claim 15, line 2, change "characterized in that" to read --wherein--;
line 3, delete "(87)"; and
line 4, delete "(13)".

Please amend claim 16 to read as follows:

--16. (Amended) Optical-fibre transmission system according to [one of
the preceding claims, characterized in that] claim 1, which includes a compensation
loop [(47) of] for the pipe of the optical-fibre cable [(10) is] being arranged ahead of
the lead-in into a cable lead-in unit [(13)].--

Claim 17, line 2, change “characterized in that” to read --wherein--;
line 3, delete “(47)”; and
line 4, delete “(13)”.

Please amend claim 18 to read as follows:

5 --18. (Amended) Optical-fibre transmission system according to [one of
the preceding claims, characterized in that] claim 1, wherein the closure housing [(5,
44) and the] has a cover [(20, 73, 74)], said housing and cover are designed to
withstand high mechanical loading and for fitting into a [drilled] core hole of a laying
route which hole is drilled in the ground[, preferably in a road surfacing].--

10 Claim 19, line 2, change the line to read --claim 1, wherein the--;
line 3, delete “(13)”; and
line 4, delete “(5, 44)”.

 Claim 20, line 2, change “one of claims 1 to 18, characterized in that” to
read --claim 1, wherein the--;
15 line 3, delete “(13)”; and
line 4, delete “(5, 44)”.

 Claim 21, line 2, change the line to read --claim 1, wherein--;
line 3, delete “that” and “(13)”;
line 4, delete “preferably”; and
20 line 5, delete “(10)”.

Claim 22, line 2, rewrite the line to read --claim 1, wherein--;

line 3, delete “(61)”;

line 4, delete “(64)” (both occurrences);

line 5, delete “(63)” and “(62)”;

5 lines 5 and 6, change “in that the” to read --an--;

line 7, delete “(61)” and “(64)”;

line 18, delete “, preferably” and “(66)”.

Claim 23, line 2, change “characterized in that” to read --wherein--;

line 3, delete “(64)”;

10 line 4, delete “(68)”.

Claim 24, line 2, change the line to read --claim 1, wherein--.

Please amend claims 25-27 to read as follows:

--25. (Amended) Optical-fibre transmission system comprising a cable closure for optical waveguides with splice organizers and excess-length depositories for excess lengths of optical waveguide and [comprising] having at least one optical-fibre cable, cable lead-in units of the cable closure being arranged in [the] an axial direction of the closure body of the cable closure, [characterized in that] the improvement comprising the cable closure [(1, 2, 1a, 1b) comprises] having an extended closure pipe [(19)], [in that] the closure pipe [(19) is] being adapted at the ends to the diameter of the pipe of the optical-fibre cable [(8, 9, 10, 15)], [in that] the leading in of the pipes of the optical-fibre cable takes place in the axial direction of the closure pipe [(19)] and [in that the] seals between the closure pipe [(19)] and the optical-fibre cables [(9, 9, 10, 15)] take place in cable lead-in units [(17-18)] adapted

15

20

in terms of pipe connecting technology to the diameters of the optical-fibre cables, the sealing connection of the cable lead-in unit [(17-18)] in terms of pipe connecting technology [comprising] being peripheral press seals.--

--26. (Amended) Optical-fibre transmission system comprising a cable closure for optical waveguides with splice organizers and excess-length depositories for excess lengths of optical waveguide and [comprising] having at least one optical-fibre cable, cable lead-in units of the cable closure being arranged in the axial direction of the closure body of the cable closure, [characterized in that] the improvement comprising the cable closure [(1, 2, 1a, 1b) comprises] having an extended closure pipe [(19)], [in that] the closure pipe [(19) is] being adapted at the ends to the diameter of the pipe of the optical-fibre cable [(8, 9, 10, 15)], [in that] the leading in of the pipes of the optical-fibre cables takes place in the axial direction of the closure pipe [(19)] and [in that] the seals between the closure pipe [(19)] and the optical-fibre cables [(8, 9, 10, 15)] take place in cable lead-in units [(17-18)] being adapted in terms of pipe connecting technology to the diameters of the optical-fibre cables, and the ends of the extended closure pipe [(19) are] being provided in terms of pipe connecting technology with an external thread, [in that] and the seals [are] being formed by union nuts [(17-18)] and elastic sealing inserts [(14)].--

--27. (Amended) Optical-fibre transmission system comprising a cable closure for optical waveguides with splice organizers and excess-length depositories for excess lengths of optical waveguide and [comprising] having at least one optical-fibre cable, cable lead-in units of the cable closure being arranged in the axial direction of the closure body of the cable closure, [characterized in that] the improvement comprising the cable closure [(1, 2, 1a) 1b) comprises] having an extended closure pipe [(19)], [in that] the closure pipe [(19) is] being adapted at the

ends to the diameter of the pipe of the optical-fibre cable [(8, 9, 10, 15)], [in that] the leading in of the pipes of the optical-fibre cables takes place in the axial direction of the closure pipe [(19)] and the optical-fibre cables [(8, 9, 10, 15)] take place in cable lead-in units [(17-18)] adapted in terms of pipe connecting technology to the diameters of the optical-fibre cables, and [in that] the seals at the ends of the extended closure pipe [(19, KM) are] being formed in terms of pipe connecting technology by crimped connections [(87)].--

Claim 28, line 2, change "one of claims 25 to 27 characterized in that" to read --claim 25, wherein--;

line 3, delete "(2)"; and

line 4, delete "(9, 15)".

Claim 29, line 2, change the line to read --claim 1, wherein the cable--; and line 3, delete "(33, 35)".

Claim 30, line 2, change "one of claims 25 to 37, characterized in that" to read --claim 1, wherein--;

line 3, delete "(33-35), or the extended closure pipe (19),";

line 4, delete ", preferably"; and

line 5, delete "(13, 36)".

Claim 31, line 2, change "2 or 25, characterized in that" to read --25, wherein--; and

line 3, delete "(13)".

Claim 32, line 2, change “characterized in that” to read --wherein--; and
line 4, delete “(33, 35)”.

Claim 33, line 2, change “characterized in that” to read --wherein the--;
same line, delete “(13)”; and
line 4, delete “(33, 35) or sections”.

Claim 34, line 2, change the line to read --claim 1, wherein the--;
line 3, delete “(5)”; and
line 4, delete “(29)”.

Claim 35, line 2, change “one of claims 1 or” to read --claim--;
same line, change “characterized in that” to read --wherein--;
line 3, delete “(68, 73, 76, 80),”;
line 4, change “(73)” to read --for--; and
line 5, change “(68, 76, 80)” to read --for--.

Claim 36, line 2, change “one of claims” to read --claim--;
same line, change “or 27, characterized in that” to read --, wherein--;
and
line 3, delete “(1)”.

Claim 37, line 2, change “one of claims” to read --claim--;
same line, change “or 17, characterized in that” to read --, wherein--;
line 3, delete “(10)”;
line 4, after “by” insert --the--; and
line 5, change “loops (47)” to read --loop--.

Claim 38, line 2, change the line to read --claim 3, wherein--.

Claim 39, line 2, change the line to read --claim 2, wherein--; and
line 3, change “hot shrink” to read --shrink--.

Please amend claim 40 to read as follows:

5 --40. (Amended) Optical-fibre transmission system according to Claim 27,
[characterized in that], wherein sealing heads [(DK1-DK4)] of plastically deformable
material[, preferably of a metal,] are crimped onto the pipes of the optical-fibre
cables [(MK1-MK6)] in a sealing manner at peripheral crimping points [(KRK)], [in
that] the closure pipe [(MR1, MR2) likewise] consists of deformable material[,
10 preferably of a metal,] and is crimped on at its end faces onto the sealing heads
[(DK1-DK4)] at the peripheral crimping points [(KRMR)], [in that] the closure pipe
[(MR1, MR2) is] being dimensioned in length [such] so that adequate excess lengths
of optical waveguide [(LU1, LU2)] can be arranged in waveform extent therein and
optical-fibre splices [(LS)] can be arranged therein--

15 Claim 41, line 2, delete “27 or”;
 same line, change “characterized in that” to read --wherein--;
 line 3, delete “(LS)” and
 line 4, delete “(KM)”.

 Claim 42, line 2, change “characterized in that” to read --wherein--;
20 line 3, delete “(LS)” and
 line 4, delete “(KM)”.

Claim 43, line 2, change "one of claims" to read --claim 1--;
same line, change "to 42, characterized in that the" to read --,
wherein a--;

line 3, delete "(BDK)";

5 same line, change "the" to read --each--;

same line, delete "(DK1, DK2)";

line 5, delete "(MK1-MK6)" and "(AS)";

lines 6 and 7, delete "(MK1-MK6)"; and

line 7, delete "(BDK)".

10 Please amend claims 44-47 to read as follows:

--44. (Amended) Optical-fibre transmission system according to [one of
claims] claim 40 [to 42], [characterized in that the] wherein each sealing head [(DK3,
DK4)] has a plurality of lead-in bores [(EB)], [in that] crimpable cable lead-in
spigots [(KES1-KES4) are] being inserted in a sealtight manner in the lead-in bores
15 [(EB)], the seals between the pipes of the optical-fibre cables [(MK1-MK6)] and the
cable lead-in spigots [(KE1-KE4)] taking place at the peripheral crimping points
[(KRK)].--

--45. (Amended) Optical-fibre transmission system according to [one of
claims] claim 40 [to 44], [characterized in that] wherein the sealing heads [(DK1-
DK4) and/or] and the closure pipe [(MR1, MR2)] consist of a material selected from
20 copper, [or] a similarly plastically deformable metal [or] and copper-based wrought
alloys.--

--46. (Amended) Optical-fibre transmission system according to [one of claims] claim 40 [to 44], [characterized in that] wherein the sealing heads [(DK1 to DK4) and/or] and the closure pipe [(MR1, MR2)] consist of a material selected from aluminum [or] and cold-workable, non-hardenable aluminum alloys.--

5 --47. (Amended) Optical-fibre transmission system according to [one of claims] claim 40 [to 44], [characterized in that] wherein the sealing heads [(DK1 to DK4) and/or] and the closure pipe [(MR1, MR2)] consist of plastically deformable, non-hardened, stainless steel.--

10 Please cancel claim 48, without prejudice, and substitute the following claim:

15 --69. A method for producing sealtight splice connections with the aid of a cable closure having a closure pipe with a sealing head at each end, each sealing head engaging a pipe of an optical fibre cable with the optical fibres of the cables being spliced together within the closure pipe, said method comprising the steps of
20 attaching a sealing head to the pipe of each optical fibre cable, pushing the closure pipe telescopically over one of the sealing heads and its respective optical fibre cable, splicing the optical fibres of the two cables together leaving an excess length on each side of the splice, then shifting the closure pipe to extend between the two sealing heads, securing the sealing heads by crimping into the ends of the closure pipe to form a sealtight structure.--

Claim 49, line 2, change the line to read --claim 40, wherein the--;
line 3, delete “(MK1)”;

line 5, delete “(MR1)”;

line 6, delete “(DK1)”.

Please amend claim 50 to read as follows:

5 --50. (Amended) Optical-fibre transmission system according to [one of
Claims] claim 2 [or 26], [characterized in that] wherein the sealing heads have
threads at their ends, [in that] deformable cutting rings are inserted at the sealing
points between the sealing head outer facings and the closure pipe and between the
sealing head bores and the pipe ends of the microcables, [in that] and the union nuts
10 which extend over the cutting rings are screwed onto the threads of the sealing
heads.--

Please cancel claim 51, without prejudice, and substitute the following
claim:

15 --70. A method of connecting a microcable comprising a pipe with lead-in
optical waveguides, which microcable is introduced into a laying channel in a firmly
laying ground to an existing optical-fibre transmission system of a conventional type
with cable closures for the optical-fibre transmission system, said method comprising
the steps of leading the microcable into an adapter closure for receiving the
microcables through a cable lead-in of a manhole of the existing optical-fibre
transmission system which has been made in the same laying ground, splicing the
20 optical waveguides of the microcable within the adapter closure onto optical
waveguides of a flexible cross-connecting cable, passing the cross-connecting cable
into a conventional splicing closure for the optical waveguides for connection to the
optical cables of the existing optical-fibre transmission system and joining the

waveguides of the cross-connecting cable to the waveguides of the optical-fibre transmission system within the splicing closure.

Claim 52, line 1, change “51” to read --70--;

line 2, delete “(105)” and “(103)”;

line 3, delete “(109)”;

line 4, delete “(110)”.

Claim 53, line 1, change “one of claims 51 or” to read --claim--;

line 2, change “characterized in that” to read --which includes forming--;

same line, delete “(108) is made”;

line 3, delete “(102)”;

lines 4 and 6, delete “(103)” (both occurrences);

line 4, change “in that” to read --and--;

line 5, delete “(105)”;

line 6, delete “(108)”;

line 7, delete “(107)”.

Claim 54, line 1, change “one of claims 51 to 53” to read --claim 70--;

line 2, change “characterized in that” to read --wherein--; and

line 3, delete “(103)”.

Please cancel claim 55, without prejudice, and substitute the following claim:

--71. A method of connecting an optical-fibre transmission system comprising a cable closure and at least one microcable comprising a pipe with lead-in optical fibres which has been introduced into a main channel and the solid laying ground to an existing optical-fibre transmission system of a conventional type having a manhole with an existing optical fibre network, said method comprising the steps of providing a buried cable at the height of the lead-in level of the manhole extending between the manhole and an adapter closure spaced from the manhole, splicing the waveguides of the buried cable to the existing optical fibre network and placing them in a splicing closure in the manhole, leading the microcable into the adapter closure and splicing the waveguides of the microcable to the waveguides of the buried cable.--

Please amend claim 56 to read as follows:

--56. (Amended) Optical-fibre transmission system according to [one of Claims] claim 16, [17 or 37, characterized in that] which includes a protective device for elongation loops of optical-fibre [cables, in particular of] microcables[,] for terminating a core hole in solid laying ground [is arranged, in that], the protective device comprises a protective cover [(SD)] and a driving-in peg [(ES),] provided centrally at one end[,] for fixing in a central hole at the bottom of the core hole [(KB), in that], the diameter of the protective cover [(SD)] corresponds to the diameter of the core hole [(KB)] and [in that] filling material is arranged above the protective cover [(SD)] for sealtight termination and for filling the remaining core hole [(KB)].--

Claim 57, line 2, change “characterized in that” to read --wherein--;
lines 2 and 3, delete “(VN1, VN2)”; and
line 3, delete “(KB)”.

Claim 58, line 2, change “one of claims” to read --claim--;
same line, change “or 57, characterized in that” to read --, wherein--;
line 3, delete “(SD)”; and
line 4, delete “(ZO)”.

Claim 59, line 2, change “one of claims” to read --claim--;
same line, change “to 58, characterized in that” to read --, wherein--;
line 3, delete “(ES)”;
line 4, delete “(KB), as”;
same line, delete “(EBS)”;
line 5, change “(DS),” to read --with--; and
line 6, delete “(MK)”.

Claim 60, line 2, change the line to read --claim 56, wherein the filling--;
and
line 4, delete “(FM)”.

Claim 61, line 2, change “characterized in that” to read --wherein--; and
line 4, delete “(FM)”.

Claim 62, line 2, change “one of claims” to read --claim--;
same line, change “to 61, characterized in that” to read --, wherein--;
line 3, delete “(KB)”;

line 4, delete “(SD)”;

line 5, delete “(MK)”.

Please amend claim 63 to read as follows:

--63. Optical-fibre transmission system according to [one of Claims] claim
1 [to 24], [characterized in that] wherein the cable closure [(KMO)] comprises an
5 outer body [(AK)] which can withstand high mechanical loads and a cable-closure
sealing body [(KDK)] fitted in the outer body [(AK)], [in that] the outer body [(AK)]
has a removable outer cover [(AD)], which lies at the same height as the surface
[(SO)] of the laying ground [(VG)], [in that] the cable-closure sealing body [(KDK)]
10 lying thereunder is closed off by an upwardly removable sealing cover [(DD)], [in
that] cable connection units [(KA1, KA2, KA3)] in pipe form are led in from below
through the outer body [(AK)] into the cable-closure sealing body [(KDK)] and [in
that] the ends of the cables [(K, MK)] are led into [these] the cable connection units
[(KA1, KA2, KA3)] and sealed off.--

15 Claim 64, line 2, change “characterized in that” to read --wherein--;
line 3, change “(MK), respectively comprising” to read --, which
comprise--;
line 5, delete “(KA)”;

line 6, delete “(KV)”.

20 Claim 65, line 2, delete “one of”;
same line, change “characterized in that” to read --wherein--;
line 3, delete “(SS)”;

line 4, delete “(KA3)” and “(K)”.

Claim 66, line 2, change the line to read --claim 63, wherein the--;
lines 3 and 4, delete “, (KA1, KA2, KA3)”;
line 5, delete “(K, MK)”;
line 6, delete “(VG)”.

5 Claim 67, line 2, change “one of claims” to read --claim--;
same line, change “to 65, characterized in that” to read --, wherein--;
and
line 3, delete “(KMO)”.

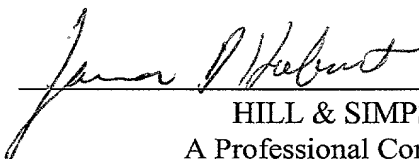
10 Claim 68, line 2, change the line to read --claim 63, wherein--;
line 4, delete “(KDK)” and “(AK)”;
line 5, delete “(FS), preferably an expandable plastic foam”.

REMARKS

Claims 1-47, 49, 50, 52-54 and 56-71 are presented for examination.

15 Claims 1-68, which were found allowably by the International Preliminary
Examination Report, have been amended to place them in U.S. form. It is
respectfully submitted that the amendments do not change the allowability of these
claims.

Respectfully submitted,

20  (Reg. No. 24,149)
HILL & SIMPSON
A Professional Corporation
85th Floor - Sears Tower
Chicago, Illinois 60606
Telephone: (312) 876-0200 - Ext. 647

25 DATED: July 17, 1998

-1-

IN THE UNITED STATES ELECTED OFFICE OF
THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY - CHAPTER II

LETTER PROPOSING DRAWING CORRECTIONS

5 APPLICANTS: Lothar Finzel, Günter Schröder and Heinz Diermeier
ATTORNEY
DOCKET NO.: P-98,1197
SERIAL NO.: EXAMINER:
FILING DATE: ART UNIT:
10 INTERNATIONAL APPLICATION NO.: PCT/DE96/02331
INTERNATIONAL FILING DATE: 5 December 1996
INVENTION: "CABLE JOINT FOR OPTICAL FIBRES WITH SPLICING
CASSETTES AND OVERLENGTH LOOPS"

BOX PCT

15 Assistant Commissioner for Patents
Washington, D.C. 20231

S I R:

Applicants propose to correct Figs. 4, 19, 21, 22 and 24, as indicated in red
in the attached sheets. If these corrections are approved, the Formal Drawings will
20 be corrected to include these changes once the application has been allowed.

Respectfully submitted,

 (Reg. No. 24,149)
HILL, STEADMAN & SIMPSON
A Professional Corporation
85th Floor - Sears Tower
Chicago, Illinois 60606
25 Telephone: (312) 876-0200 - Ext. 647

DATED: July 17, 1998

2/18

FIG 4

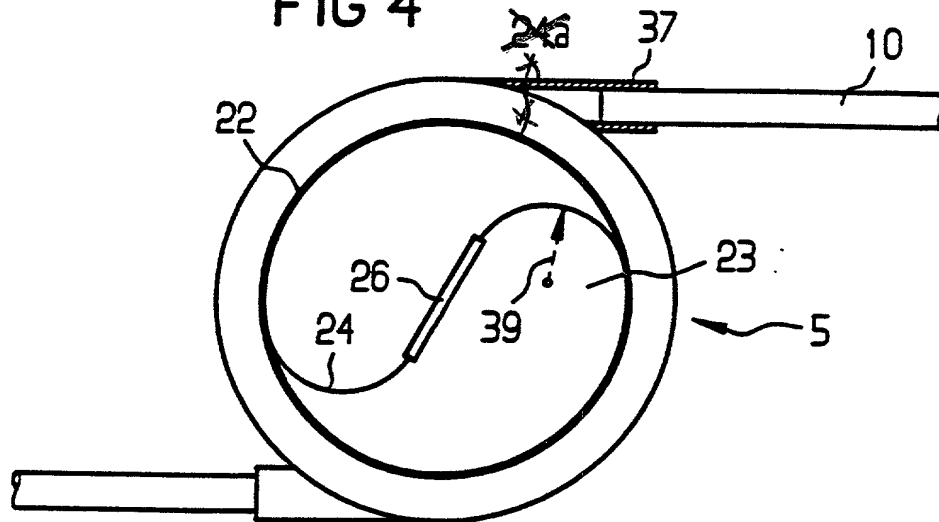
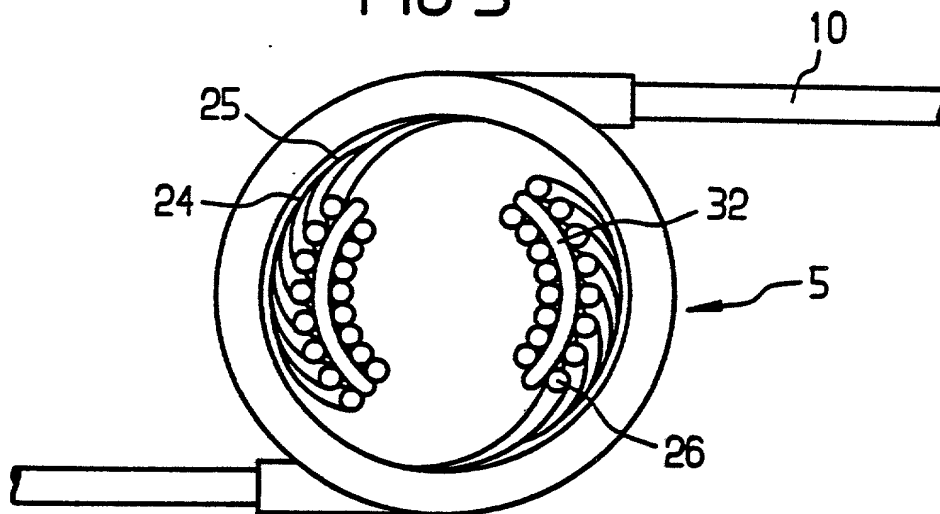


FIG 5



11/18

FIG 18

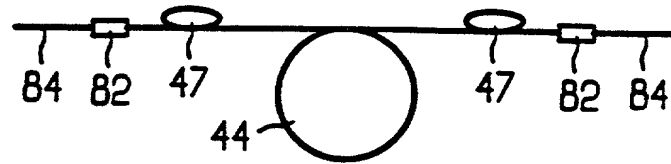


FIG 19

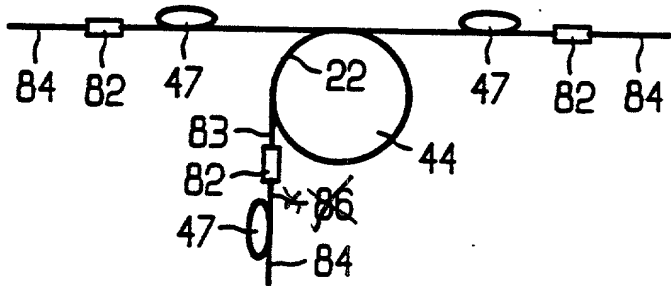


FIG 20

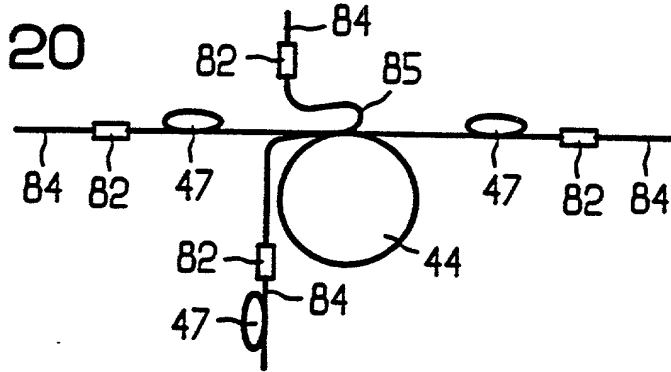
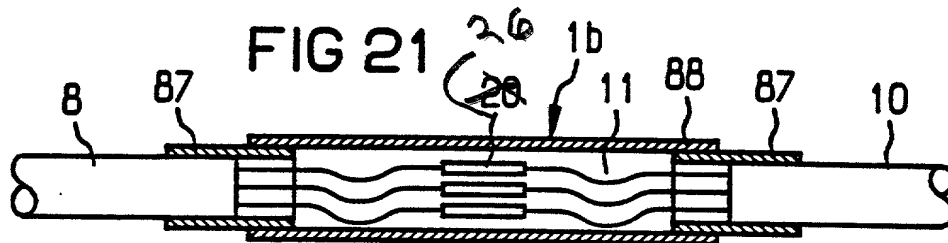


FIG 21



12/18

FIG 22

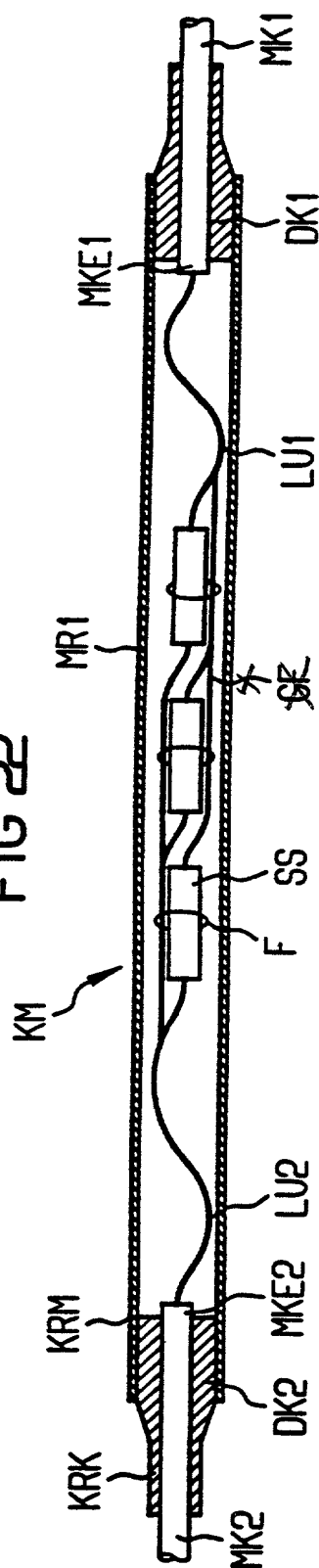


FIG 23

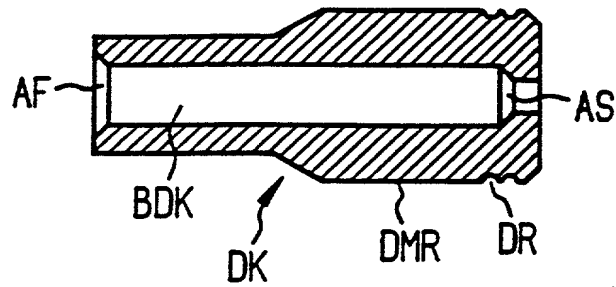


FIG 24

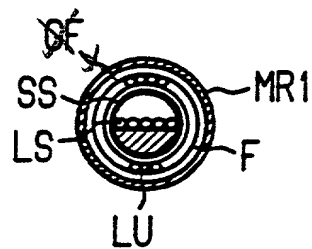


FIG 25

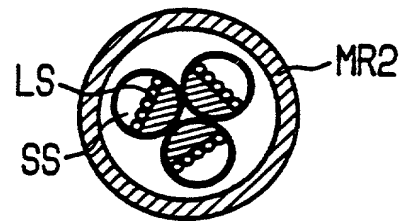
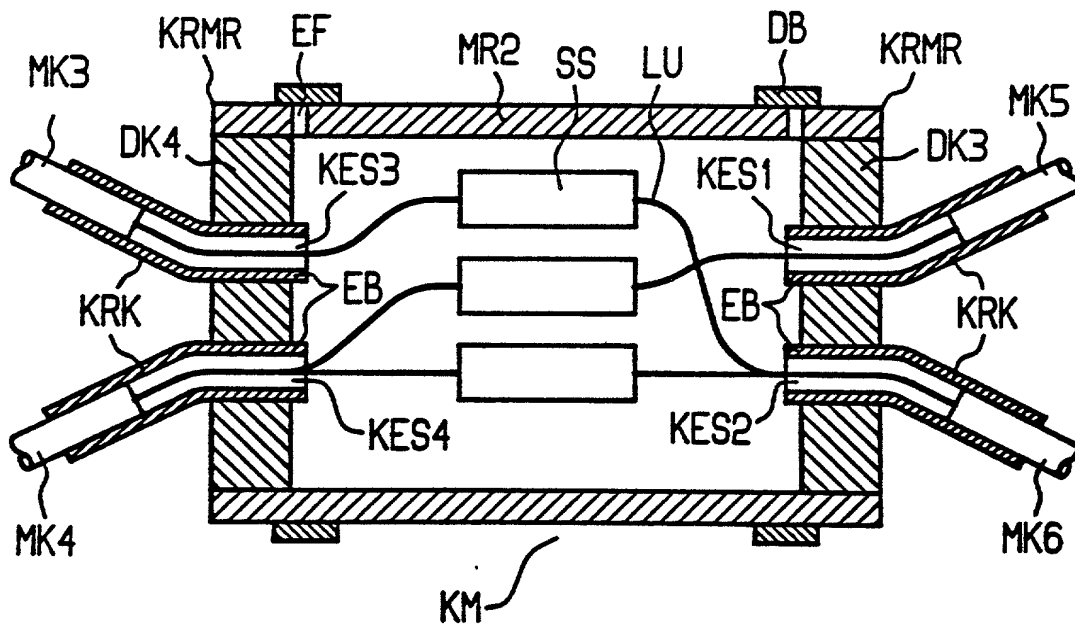


FIG 26



German Language Declaration

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem Patent- und Warenzeichenamt: (Name und Registrationsnummer anführen)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

And I hereby appoint

Messrs. John D. Simpson (Registration No. 19,842), Lewis T. Steadman (17,074), William C. Stueber (16,453), P. Phillips Connor (19,259), Dennis A. Gross (24,410), Marvin Moody (16,549), Steven H. Noll (28,982), Brett A. Valiquet (27,841), Thomas I. Ross (29,275), Kevin W. Guynn (29,927), Edward A. Lehmann (22,312), James D. Hobart (24,149), Robert M. Barrett (30,142), James Van Santen (16,584), J. Arthur Gross (13,615), Richard J. Schwarz (13,472), and Melvin A. Robinson (31,870), David R. Metzger (32,919), John R. Garrett (27,888) all members of the firm of Hill, Steadman & Simpson, A Professional Corporation.

Telefongespräche bitte richten an:
(Name und Telefonnummer)

Direct Telephone Calls to: (name and telephone number)

312/876-0200
Ext. _____

Postanschrift:

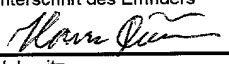
Send Correspondence to:

HILL, STEADMAN & SIMPSON
A Professional Corporation
85th Floor Sears Tower, Chicago, Illinois 60606

Voller Name des einzigen oder ursprünglichen Erfinders:		Full name of sole or first inventor:	
FINZEL, Lothar			
Unterschrift des Erfinders	Datum	Inventor's signature	Date
<i>Lothar Finzel</i>	6.11.96		
Wohnsitz		Residence	
D-85617 Unterschleißheim, Germany <i>DEX</i>			
Staatsangehörigkeit		Citizenship	
Bundesrepublik Deutschland			
Postanschrift		Post Office Address	
Im Klosterfeld 92			
D-85617 Unterschleißheim			
Bundesrepublik Deutschland			
Voller Name des zweiten Miterfinders (falls zutreffend):		Full name of second joint inventor, if any:	
SCHRÖDER, Günter			
Unterschrift des Erfinders	Datum	Second Inventor's signature	Date
<i>Günter Schröder</i>	6.11.96		
Wohnsitz		Residence	
D-82140 Esting, Germany <i>DEX</i>			
Staatsangehörigkeit		Citizenship	
Bundesrepublik Deutschland			
Postanschrift		Post Office Address	
Jeisstraße 26a			
D-82140 Esting			
Bundesrepublik Deutschland			

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).

Voller Name des dritten Miterfinders:		Full name of third joint inventor:	
DIERMEIER, Heinz			
Unterschrift des Erfinders	Datum	Inventor's signature	Date
	6-11-96		
Wohnsitz		Residence	
D-81739 München, Germany OEX			
Staatsangehörigkeit		Citizenship	
Bundesrepublik Deutschland			
Postanschrift		Post Office Address	
Melanchthonstraße 6			
D-81739 München			
Bundesrepublik Deutschland			
Voller Name des vierten Miterfinders (falls zutreffend):		Full name of fourth joint inventor, if any:	
Unterschrift des Erfinders	Datum	Inventor's signature	Date
Wohnsitz		Residence	
Staatsangehörigkeit		Citizenship	
Postanschrift		Post Office Address	
Voller Name des fünften Miterfinders (falls zutreffend):		Full name of fifth joint inventor, if any:	
Unterschrift des Erfinders	Datum	Inventor's signature	Date
Wohnsitz		Residence	
Staatsangehörigkeit		Citizenship	
Postanschrift		Post Office Address	
Voller Name des sechsten Miterfinders (falls zutreffend):		Full name of sixth joint inventor, if any:	
Unterschrift des Erfinders	Datum	Inventor's signature	Date
Wohnsitz		Residence	
Staatsangehörigkeit		Citizenship	
Postanschrift		Post Office Address	

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).